



Pacific Scientific Energetic Materials Co.

<<<<< MATERIAL SAFETY DATA SHEET >>>>>

1. **CHEMICAL PRODUCT AND COMPANY IDENTIFICATION**

PRODUCT NAME: Cartridge, Aircraft Fire Extinguisher
TRADE NAME(S) / SYNONYM(S): Fire Extinguisher Cartridge with BNCP;
AVRO Cartridge
PRODUCT NUMBER(S): 2-102100-1 [30903924-1]
2-102100-2 [30903924-2]
2-102110-1, 2-101187-1 (in-house, sub-assemblies)
MSDS NUMBER / SPECIFYING LETTER: 00196 A
REVISION DATE: 8 April 99
SHIPPING REFERENCE NUMBER: US DOT Competent Authority: EX-9703145

MANUFACTURER: Danaher Corporation - Pacific Scientific Energetic Materials Co.
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2. **COMPOSITION / INFORMATION ON INGREDIENTS**

HAZARDOUS INGREDIENTS (* - below required reporting levels per OSHA, 29 CFR § 1900.1200)

COMPONENT NAME / CAS NUMBER: hexanitrostilbene (HNS) / 20062-22-0
WEIGHT PERCENTAGE: < 1 %*

COMPONENT NAME / CAS NUMBER: tetraammine-*cis-bis*(5-nitro-2H-tetraazolato-N²) cobalt^{III} perchlorate (BNCP) / 178959-25-6
WEIGHT PERCENTAGE: < 1 %*

COMPONENT NAME / CAS NUMBER: zirconium, metal powder / 7440-67-7
WEIGHT PERCENTAGE: < 0.1 %*

COMPONENT NAME / CAS NUMBER: potassium perchlorate (KP) / 7778-74-7
WEIGHT PERCENTAGE: < 0.1 %*

COMPONENT NAME / CAS NUMBER: silicon, amorphous powder / 7440-21-3
WEIGHT PERCENTAGE: < 0.1 %*

COMPONENT NAME / CAS NUMBER: (red) iron^{III} oxide [Fe₂O₃] / 1309-37-1
WEIGHT PERCENTAGE: < 0.1 %*

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COMPONENT NAME / CAS NUMBER: diatomaceous earth / 68855-54-9
WEIGHT PERCENTAGE: < 0.1 %*

COMPONENT NAME / CAS NUMBER: cristabolite (silica, crystalline) [SiO₂] / 14464-46-1 (ref. 14808-60-7)
WEIGHT PERCENTAGE: < 0.1 %*

COMPONENT NAME / CAS NUMBER: dibutyl bis(lauroyloxy) stannane (DBT) / 77-58-7
WEIGHT PERCENTAGE: < 0.1 %*

NET EXPLOSIVE WEIGHT (NEW): 142 - 144 mg

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

WARNING: Explosive Product ! Do not attempt to manually fight fires. Product may be sensitive to shock, impact, friction, electrostatic discharge, high pressure or high temperature. Product may ignite and explode if exposed to any of these conditions, releasing toxic fumes, heat, shock waves and container fragments.

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

EYES: The product is sealed preventing exposure to the hazardous ingredients inside. If product seal ruptures exposing hazardous ingredients inside, discard product avoiding contact with the eyes. Exposure to ignition products may cause eye irritation.

SKIN: The product is sealed preventing exposure to the hazardous ingredients inside. If product seal ruptures, discard product avoiding contact with the skin. Poses little or no immediate hazard. Exposure to ignition products may cause skin irritation.

INHALATION: The product is sealed preventing exposure to the hazardous ingredients inside. Exposure to ignition products may cause respiratory irritation. Ignition products will contain zirconium, silicon, tin, cobalt, iron and chlorine compounds; plus nitrogen oxides.

INGESTION: Not a hazard in normal industrial use. If product seal ruptures, discard product using proper protection. Some ingredients are highly poisonous by ingestion.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Pre-existing pulmonary diseases such as emphysema, asthma, etc. may be aggravated by overexposure to ignition products.

CARCINOGENICITY (CANCER) LISTING STATUS

OSHA: Neither the product nor its hazardous components are listed

IARC: 2A - Limited Evidence (cristabolite)
2B - Limited Evidence (cobalt compound)

NTP: 2 - Anticipated Carcinogen (cristabolite)

NIOSH: Potential Occupational Carcinogen (cristabolite)

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ACGIH: A3 - Animal Carcinogen (inorganic cobalt compound, as cobalt)
A4 - Inadequate Evidence (tin-organic compound, iron^{III} oxide)

REFER TO SECTION 11, TOXICOLOGICAL INFORMATION, FOR ADDITIONAL DATA.

4. FIRST AID MEASURES

EYES: If exposed to container fragmentation, bandage eyes and transport. If exposed to ignition byproducts, remove contact lenses immediately, flush with water for at least 15 minutes, occasionally lifting upper and lower eyelids. Seek medical attention if needed.

SKIN: Wash off any residue with soap and warm water. Seek medical attention if irritation develops.

INHALATION: Remove to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, administer oxygen. Seek immediate medical attention.

INGESTION: Seek immediate medical attention.

NOTE TO PHYSICIAN: Supportive care. Product ignition produces small quantities of zirconium, silicon, tin, cobalt, iron and chlorine compounds; plus nitrogen oxides. Treatment based on judgement of the physician in response to reactions of the patient.

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES

FLASH POINT: not applicable

METHOD USED: not applicable

LOWER FLAMMABLE LIMIT: self-oxidizing

UPPER FLAMMABLE LIMIT: self-oxidizing

AUTOIGNITION TEMPERATURE: $\geq 480^{\circ}\text{F}$ ($\geq 250^{\circ}\text{C}$) by DSC [BNCP]

FIRE AND EXPLOSION HAZARD: WARNING - Explosive Product ! Product may be sensitive to shock, impact, friction, electrostatic discharge, high pressure or high temperature. Must not be confined if burning. Product may deflagrate or detonate if exposed releasing toxic fumes, heat, shock waves and container fragments.

EXTINGUISHING MEDIA: Permanently-installed, automatic water sprinkler / deluge system is recommended.

FIRE FIGHTING INSTRUCTIONS: Do not attempt to manually fight fires. In case of fire, personnel should immediately evacuate the area, using as much protective cover as possible and activate deluge and alarm systems.

HAZARDOUS COMBUSTION PRODUCTS: Extreme heat and toxic gases containing zirconium, silicon, tin, cobalt, iron and chlorine compounds; plus nitrogen oxides may be emitted during ignition.

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6. ACCIDENTAL RELEASE MEASURES

SMALL SPILL: If product seal ruptures, barricade area, eliminate ignition sources, use a soft bristle brush and a conductive rubber pan or rubber shovel to clean-up spills. Use conductive containers and ground all containers when transferring the spilled material. Refer to Section 9 for the proper desensitizing agent to wet and desensitize the spilled material.

LARGE SPILL

SOIL SPILL: Remove all contaminated soil to dispose of as hazardous waste.

AIR RELEASE: Not applicable

WATER SPILL: Flush with copious amounts of water. Collect water to dispose of as hazardous waste.

OCCUPATIONAL SPILL: If product seal ruptures, barricade area and eliminate ignition sources. Refer to SMALL SPILL above.

7. HANDLING AND STORAGE

HANDLING: Handling and use of explosives and related dangerous materials must be limited to personnel who are specifically authorized and trained in this area. Refer to the Department of Defense Contractors Safety Manual number DOD4145.26M, including sources listed within, and any other appropriate information for detailed instructions regarding proper handling, storage, use and disposal of explosives and related dangerous material.

STORAGE: Store in approved storage magazines only. Storage and handling must conform to appropriate quantity / distance requirements, barricading, grounding and personnel material limits. Keep product cool and dry in storage.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

PERSONAL PROTECTIVE EQUIPMENT (PPE)

EYE PROTECTION: Industrial safety glasses or goggles must be worn when handling any type of explosive product.

SKIN PROTECTION

GLOVES: Impervious, static-dissipative gloves are recommended if product seal ruptures.

CLOTHING: High cotton-content clothing and underclothing, as well as conductive shoes or legstat(s), wristat(s) and a static-dissipative coat, are recommended to avoid static electricity build-up.

EMERGENCY WASH FACILITY: Eye washing capability is required.

RESPIRATORY PROTECTION: Appropriate NIOSH / MSHA-approved respiratory protection is recommended if exposed to particulate matter, and, for protection against toxic gaseous ignition products, but should not be necessary with normal handling.

OTHER PROTECTION: None indicated.

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ENGINEERING CONTROLS: Effective shielding is recommended for personnel when handling these devices. Humidity control (i.e. higher relative humidity, > 60% as recommended by DOD) reduces or prevents static electricity build-up. Explosion-proof equipment is required when operating with exposed explosive materials.

VENTILATION

LOCAL: Not required.

SPECIAL: Explosion-proof electrical is required, where applicable.

MECHANICAL: General-coverage, moderate-flow, is recommended for particulate and ignition product removal.

EXPOSURE GUIDELINES:

COMPONENT: cristabolite (silica, crystalline) [SiO₂]

OSHA TWA: < 0.3 mg/m³ [total dust] (based on % silica),
< 0.1 mg/m³ [respirable frxn] (based on % silica)

OSHA STEL: not found

ACGIH TWA: 0.05 mg/m³ [respirable fraction]

ACGIH STEL: not found

OTHER: **NIOSH-TWA:** 0.05 mg/m³

IDLH: 50 mg/m³

COMPONENT: tetraammine-*cis-bis*(5-nitro-2H-tetrazolato-N²)
cobalt^{III} perchlorate (BNCP)

OSHA TWA: 0.1 mg/m³ [cobalt (Co) dust / fume]

OSHA STEL: not found

ACGIH TWA: 0.02 mg/m³ [as cobalt (Co), inorganic compound]

ACGIH STEL: not found

OTHER(S): **NIOSH-TWA:** 0.05 mg/m³ [cobalt (Co) dust / fume]

IDLH: 20 mg/m³ [as cobalt, Co]

COMPONENT: dibutyl *bis*(lauroyloxy) stannane (DBT)

OSHA TWA: 0.1 mg/m³ [skin] (as tin, Sn)

OSHA STEL: not found

ACGIH TWA: 0.1 mg/m³ [skin] (as tin, Sn)

ACGIH STEL: not found

OTHER: **NIOSH-TWA:** 0.1 mg/m³ [skin] (as tin, Sn)

IDLH: 25 mg/m³ (as tin, Sn)

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COMPONENT: diatomaceous earth (silica, amorphous powder) [SiO₂]

OSHA TWA: 1 mg/m³ (based on % silica)
OSHA STEL: not found

ACGIH TWA: 3 mg/m³ [respirable fraction]
ACGIH STEL: not found

OTHER: **NIOSH-TWA:** 6 mg/m³ [total],
5 mg/m³ [respirable fraction]

IDLH: 3000 mg/m³

COMPONENT: zirconium, metal powder [Zr]

OSHA TWA: 5 mg/m³
OSHA STEL: not found

ACGIH TWA: 5 mg/m³
ACGIH STEL: 10 mg/m³

OTHER: **NIOSH-TWA:** 5 mg/m³
NIOSH-STEEL: 10 mg/m³

IDLH: 50 mg/m³

COMPONENT: (red) iron^{III} oxide [Fe₂O₃]

OSHA TWA: 10 mg/m³ (as iron (Fe), total dust and fume)
5 mg/m³ (respirable fraction)

OSHA STEL: not found

ACGIH TWA: 5 mg/m³ (as Fe)
ACGIH STEL: not found

OTHER: **NIOSH-TWA:** 5 mg/m³ (as iron, Fe)

IDLH: 2500 mg/m³ (as iron, Fe)

COMPONENTS: hexanitrostilbene (HNS)
potassium perchlorate [KClO₄]
silicon [Si]

OSHA TWA: 15 mg/m³ [total],
5 mg/m³ [respirable dust fraction] (PNOR)

OSHA STEL: not found

ACGIH TWA: 10 mg/m³ [total particulate],
3 mg/m³ [respirable particulate] (PNOC)

ACGIH STEL: not found

OTHER: none found

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9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE:	metallic ordnance hardware
ODOR:	odorless
PHYSICAL STATE:	solid
pH @ 25°C:	not determined
VAPOR PRESSURE:	not applicable, sealed product
VAPOR DENSITY:	not applicable, sealed product
BOILING POINT:	not applicable
MELTING POINT:	not applicable
SOLUBILITY IN H ₂ O:	negligible
SPECIFIC GRAVITY (H ₂ O=1):	greater than 1
BULK DENSITY:	greater than 1, identical to specific gravity
CHEMICAL FAMILY:	not applicable
MOLECULAR WEIGHT:	not applicable
MOLECULAR FORMULA:	not applicable
VISCOSITY:	not applicable
EVAPORATION RATE:	not applicable, sealed product
DECOMPOSITION TEMP:	≥ 480°F (≥ 250°C) by auto-ignition [BNCP]
DESENSITIZING AGENT:	<u>CAUTION:</u> The product may only be desensitized if large volumes of water or mineral oil come in contact with the explosive components inside. Sealed units should be shunted and disposed of in accordance with Section 13.
VOC CONTENT:	none

10. STABILITY AND REACTIVITY

CHEMICAL STABILITY: This explosive product is stable if handled properly. Avoid conditions listed below.

CONDITIONS TO AVOID: Shock, impact, friction, electrostatic discharge, high pressure, high temperature, open flame and chemical or physical contamination.

INCOMPATIBILITY WITH OTHER MATERIALS: The product is sealed preventing exposure to the hazardous ingredients inside. If the seal ruptures, remove all other hazardous materials.

HAZARDOUS DECOMPOSITION PRODUCTS: Extreme heat and toxic gases containing zirconium, cobalt and fluorine compounds; plus nitrogen oxides may be emitted during ignition.

HAZARDOUS POLYMERIZATION: Will not occur.

11. TOXICOLOGICAL INFORMATION

HEALTH HAZARDS/TOXICOLOGY: The product is sealed preventing exposure to the hazardous ingredients inside. If the seal ruptures, remove all other hazardous materials.

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HNS and BNCP (as a nitro compounds of an aromatic hydrocarbons): Skin absorption and inhalation are usual routes of entry for these materials. The effects of acute exposure are the reduction of oxygen-carrying power of the blood and depression of the nervous system.

Chronic exposure may cause anemia, moderate cyanosis, fatigue, slight dizziness, headache, insomnia and weight loss. Prolonged chronic exposure may lead further to liver and/or kidney damage, manifesting as acute yellow atrophy and toxic hepatitis or fatty degeneration of the kidneys.

LD₅₀: no data found

BNCP (as a cobalt compound): Low toxicity by ingestion. Ingestion of soluble salts produces nausea and vomiting by local irritation; possibly can cause liver and kidney damage. Locally, cobalt has been shown to cause dermatitis and hypersensitivity of the skin. Animal carcinogen (AGCIH) and suspected human carcinogenicity. Further reports, state both confirmed and questionable carcinogen with experimental neoplastigenic and tumorigenic data.

LD₅₀: no data found

zirconium: Inhalation may lead to lung granulomas. Fine zirconium powder readily generates respirable dust, which is retained in the lungs. Fine powder imbeds in skin, eyes and other exposed tissues.

LD₅₀: no data found

potassium perchlorate and BNCP (as a perchlorate): Implicated in aplastic anemia. Absorption can cause methemoglobinemia and kidney injury. An experimental teratogen.

LD₅₀: no data found

silicon: Identified as a nuisance dust with low order of toxicity. Chronic exposure may lead to chronic bronchitis.

LD₅₀: no data found

iron^{III} oxide: When heated to vaporization, iron oxide will emit iron oxide fume, which is a cause of 'metal fume fever'. Heavy iron oxide dust inhalation can cause benign pneumoconiosis. A poison by subcutaneous route.

LD₅₀: 5400 mg/kg; intraperitoneal; mouse

diatomaceous earth: The dust may cause fibrosis of the lungs.

LD₅₀: no data found

cristabolite: Poison by intratracheal route. Inhalation will cause cough, dyspnea, fibrosis of the lungs and SILICOSIS.

LD₅₀: no data found

dibutyl bis(lauroyloxy) stannane (DBT): Poison by ingestion and intraperitoneal routes.

LD₅₀: no data found

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12. ECOLOGICAL INFORMATION

The product is sealed preventing exposure to the hazardous ingredients inside. If the seal ruptures, the small amount of hazardous ingredients inside should have no ecological impact.

13. DISPOSAL CONSIDERATIONS

RCRA HAZARDOUS WASTE CODES (product as manufactured):

D003 - reactive characteristic

WASTE DISPOSAL METHOD: Explosives or related dangerous material should be destroyed by open burning/open detonation in an approved incinerator, or by another approved method such as chemical treatment/destruction. Contaminated property must not be buried.

REGULATIONS GOVERNING TREATMENT, STORAGE AND DISPOSAL OF HAZARDOUS WASTE IS SUBJECT TO CHANGE AND REINTERPRETATION. SINCE THE OWNER OF THE WASTE IS RESPONSIBLE FOR PROPER DISPOSAL, CHECK WITH FEDERAL, STATE AND LOCAL ENVIRONMENTAL AGENCIES IF IN DOUBT OF THE REQUIREMENTS OF APPLICABLE LAWS, RULES AND REGULATIONS. TREATMENT, STORAGE AND DISPOSAL MUST BE IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE AND LOCAL LAWS, RULES AND REGULATIONS.

14. TRANSPORT INFORMATION

U.S. DEPARTMENT OF TRANSPORTATION INFORMATION

For general emergency response guidance, actions and potential hazards, refer to the "1996 North American Emergency Response Guidebook", **GUIDE NUMBER 114.**

UN PROPER SHIPPING NAME/NUMBER: Cartridges, power device, UN0276

UN CLASSIFICATION CODE: 1.4C

PACKAGING GROUP: II

LABEL(S) REQUIRED: EXPLOSIVE 1.4C, CARGO AIRCRAFT ONLY

APPLICABLE PACKAGING SECTION: 49 CFR § 173.62 non-bulk [PI-134], plus special provision 110 per 49 CFR § 172.102

DOT REPORTABLE QUANTITY (RQ): 100 lbs. (45.4 kg) per 49 CFR § 172.101, Appendix (D003 reactivity)

OTHER TRANSPORTATION INFORMATION: This product is regulated as a US DOT Hazardous Material. Applicable regulations are found in title 49 of the Code of Federal Regulations. An authorized carrier in full compliance with these regulations must be used to transport this product. This product may not be mailed through the US Postal system.

15. REGULATORY INFORMATION

U.S. REGULATIONS

FEDERAL

OSHA: Regulated under 29 CFR § 1910.1200

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TSCA: All hazardous components should be reported on the inventory.

CERCLA RQ: 100 lbs. (45.4 Kgs) [D003 reactivity]

SARA - SECTION 302 TPQ: Not an Extremely Hazardous Substance

- **SECTION 304 RQ:** See CERCLA RQ.

- **SECTION 313:** Reportable [cobalt compound]

STATES

CALIFORNIA PROPOSITION 65: The product and its hazardous components are not on their list.

NEW JERSEY RIGHT-TO-KNOW: The product (as EXPLOSIVES C) and the components, zirconium, potassium perchlorate, silicon, iron^{III} oxide, diatomaceous earth, cristabolite, HNS and BNCP (as a cobalt compound and a perchlorate, inorganic, n.o.s.), are on the Right-to-Know Hazardous Substance List (rev. 3/93), which consists of both the Workplace Hazardous Substance List and the Environmental Hazardous Substance List. Zirconium and potassium perchlorate are on the Special Health Hazard Substance List.

PENNSYLVANIA RIGHT-TO-KNOW: The components, zirconium, potassium perchlorate, iron^{III} oxide, diatomaceous earth, cristabolite and BNCP (as a cobalt compound), are on the Hazardous Substance List. Cobalt compounds are listed as Environmental Hazards. None are included as Special Hazardous Substances.

INTERNATIONAL REGULATIONS

To be determined

16. OTHER INFORMATION

HMIS RATINGS (Sealed product rating):

HEALTH: 1 FLAMMABILITY: 0 REACTIVITY: 4
PERSONAL PROTECTION: A + X

CERCLA or NFPA RATINGS (SCALE 0-4): Not included

REVISION HISTORY

Initial issue: 10 December 96, ANSI Z400.1

PREPARED BY: J. Geving - Environmental, Health & Safety

THE INFORMATION, RECOMMENDATIONS AND SUGGESTIONS IN THIS DATA SHEET ARE BASED ON AVAILABLE DATA BELIEVED TO BE ACCURATE AND RELIABLE. IT IS THE RESPONSIBILITY OF THE USER TO DETERMINE THE SUITABILITY FOR USE OF THIS PRODUCT OR USE IN COMBINATION WITH ANY OTHER DEVICE, MATERIAL OR PROCESS. NO WARRANTY, EITHER EXPRESSED OR IMPLIED, IS MADE CONCERNING THE EFFECTS OF USE OR THE RESULTS TO BE OBTAINED, NOR DOES PACIFIC SCIENTIFIC COMPANY ASSUME ANY LIABILITY ARISING OUT OF USE, STORAGE, HANDLING OR DISPOSAL OF THE PRODUCT REFERRED TO HEREIN. TO PROMOTE SAFE USE OF THIS PRODUCT, THE USER SHOULD NOTIFY HIS EMPLOYEES, AGENTS, CONTRACTORS AND CLIENTS OF THE PRODUCT HAZARDS AND SAFETY INFORMATION AFTER BECOMING FAMILIAR WITH THIS DATA.