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**In Case of Emergency, Call
1-800-327-8633 (FAST MED)**

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MSDS prepared by:

Department of Regulatory & Biology Development
Syngenta Crop Protection Canada, Inc.

**For further information contact:
1-87-SYNGENTA (1-877-964-3682)**

SECTION – 1: PRODUCT IDENTIFICATION

Product Identifier: BRAVO® ZN

Formulation No.: A7867G

Registration Number: 28900 (Pest Control Products Act)

Chemical Class: Chlorinated benzonitrile fungicide.

Synonym: None

Active Ingredient (%): Chlorothalonil (38.5 %)

CAS NO.: 1897-45-6

Chemical Name : Tetrachloroisophthalonitrile

Product Use: Water based fungicide concentrate to be mixed with water and used to control diseases in potato crops. Fungicide. Please refer to product label for further details.

SECTION – 2 : COMPOSITION/INFORMATION ON INGREDIENTS

Material	OSHA PEL	ACGIH TLV	Other	NTP/IARC/OSHA Carcinogen	WHMIS†
Amorphous Silica	80 mg/m ³ / %SiO ₂ TWA (total dust)	10 mg/m ³ TWA (respirable dust)	6 mg/m ³ TWA **	IARC Group 3	Not Established
Propylene Glycol CAS No. 57-55-6	Not Established	Not Established	50 ppm TWA ****	No	Yes
Chlorothalonil (38.5%)	Not Established	Not Established	0.1 mg/m ³ TWA (possible skin and respiratory sensitizer) ***	IARC Group 2B	Not Established

** Recommended by NIOSH

*** Syngenta Occupational Exposure Limit (OEL)

**** Recommended by AIHA (American Industrial Hygiene Association)

† Material listed in Ingredient Disclosure List under Hazardous Products Act.

Ingredients not precisely identified are proprietary or non-hazardous. Values are not product specifications.

SECTION – 3: HAZARDS IDENTIFICATION

Symptoms of Acute Exposure

A severe eye irritant... May cause skin irritation, prolonged or frequently repeated skin contact may cause allergic reaction in some individuals. Overexposure to spray mist may cause respiratory tract irritation and possible respiratory sensitization.

Hazardous Decomposition Products

Can decompose at high temperatures forming toxic gases.

Physical Properties

Appearance: Gray viscous suspension.

Odour: Slight.

Unusual Fire, Explosion and Reactivity Hazards

During a fire, irritating and possibly toxic gases may be generated by thermal decomposition or combustion.

Potential Health Effects

Relevant routes of exposure: Skin, eyes, mouth, lungs.

SECTION – 4: FIRST AID MEASURES

IF POISONING IS SUSPECTED, immediately contact the poison information centre, doctor or nearest hospital. Have the product container, label or Material Safety Data Sheet with you when calling Syngenta, a poison control center or doctor, or going for treatment. Tell the person contacted the complete product name, and the type and amount of exposure. Describe any symptoms and follow the advice given. Call the Syngenta Emergency Line [**1-800-327-8633 (1-800-FASTMED)**], for further information.

EYE CONTACT: Flush eyes with clean water, holding eyelids apart for a minimum of 20 minutes. Remove contact lenses, if present, after 5 minutes, then continue rinsing eye. Call Syngenta, a poison control center or doctor for treatment advice. Obtain medical attention immediately if irritation persists.

SKIN CONTACT: Immediately remove contaminated clothing and wash skin, hair and fingernails thoroughly with soap and water. Flush skin with plenty of water for 15-20 minutes. Call Syngenta, a poison control centre or doctor for treatment advice.

INHALATION: Move victim to fresh air. If not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth, if possible. Call Syngenta, a poison control centre or doctor for treatment advice.

INGESTION: If swallowed, immediately contact Syngenta, a poison control centre, doctor or nearest hospital for treatment advice. Have person sip a glass of water if able to swallow. Do not give anything by mouth to an unconscious person. Do not induce vomiting unless directed by a physician or a poison control center. If spontaneous vomiting occurs, have victim lean forward with head down to avoid breathing in of vomitus, rinse mouth and administer water.

NOTES TO PHYSICIAN:

There is no specific antidote if this product is ingested. Treat symptomatically. Persons suffering with temporary allergic skin reactions may respond to treatment with oral antihistamines and topical or oral steroids.

MEDICAL CONDITIONS KNOWN TO BE AGGRAVATED:

Asthma or other respiratory conditions may be aggravated by chemical irritants.

SECTION – 5: FIRE FIGHTING MEASURES

Flash point and method: Not applicable.

Upper and lower flammable (explosive) limits in air: Not applicable.

Auto-ignition temperature: Not applicable.

Flammability: Not flammable.

Hazardous combustion products: During a fire, irritating and possibly toxic gases may be generated by thermal decomposition or combustion.

Conditions under which flammability could occur: Keep fire exposed containers cool by spraying with water.

Extinguishing media: Use water fog or mist, (avoid use of water jet), foam, carbon dioxide, dry powder or halon extinguishant. Wear full protective clothing and self-contained breathing apparatus. Evacuate nonessential personnel from the area to prevent human exposure to fire, smoke, fumes or products of combustion. Prevent use of contaminated buildings, area, and equipment until decontaminated. Water runoff can cause environmental damage. Contain run-off water with, for example, temporary earth barriers.

Sensitivity to explosion by mechanical impact: None known.

Sensitivity to explosion by static discharge: None known.

SECTION – 6: ACCIDENTAL RELEASE MEASURES

Personal Precautions: Make sure all personnel involved in the spill cleanup follow good industrial hygiene practices. A small spill can be handled routinely. Wear suitable protective clothing and eye protection to prevent skin and eye contact. See Section 8 for personal protective equipment and clothing.

Procedures for dealing with release or spill: Control the spill at its source. Contain the spill to prevent from spreading or contaminating soil or from entering sewage and drainage systems or any body of water. Clean up spills immediately, observing precautions outlined in Sections 7 and 8. Pump or scoop large amounts of liquid into a disposable container. Absorb remaining liquid or smaller spills with clay, sand or vermiculite. Scoop or sweep up material and place into a disposable container. Wash area with detergent and water. Pick up wash liquid with additional absorbent and place into compatible disposal container. On soils, skim off the upper contaminated layer and collect for disposal. Once all material is cleaned up and placed in a disposal container, seal container and arrange for disposal. Spillages or uncontrolled discharges into watercourses must be reported to the appropriate regulatory authority.

SECTION – 7: HANDLING AND STORAGE

Handling practices: KEEP OUT OF REACH OF CHILDREN. Prevent eating, drinking, tobacco use, and cosmetic application in areas where there is a potential for exposure to the material. Wear full protective clothing and equipment (see Section 8). After work, rinse gloves and remove protective equipment. Wash hands thoroughly with soap and water after working with product, and before eating, handling tobacco, drinking, or using the toilet. Wash contaminated clothing separate from household laundry before re-use. Keep containers closed when not in use. Protect product, wash or rinse water, and contaminated materials from uncontrolled release into the environment, or from access by animals, birds or unauthorized people.

Appropriate storage practices/requirements: Store in original container only in a well-ventilated, cool, dry, secure area. Protect from heat, sparks and flame. Do not expose sealed containers to temperatures above 40 °C. Keep separate from other products to prevent cross contamination. Rotate stock. Clean up spilled material immediately.

National Fire Code classification: Not specified.

SECTION – 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

Applicable control measures, including engineering controls: This product is intended for use outdoors where engineering controls are not necessary. If necessary, ensure work areas have ventilation, containment, and procedures sufficient to maintain airborne levels below the TLV. Warehouses, production area, parking lots and waste holding facilities must have adequate containment to prevent environmental contamination. Provide separate shower and eating facilities.

THE FOLLOWING RECOMMENDATIONS FOR EXPOSURE CONTROLS/PERSONAL PROTECTION ARE INTENDED FOR THE MANUFACTURE, FORMULATION, PACKAGING AND USE OF THIS PRODUCT.

CONSULT THE PRODUCT LABEL FOR COMMERCIAL APPLICATIONS AND/OR ON-FARM APPLICATIONS.

Personal protective equipment for each exposure route:

General: Avoid breathing dust, vapours or aerosols. Avoid contact with eye, skin and clothing. Wash thoroughly after handling and before eating, drinking, applying cosmetics or handling tobacco.

INGESTION: Do not eat, drink, handle tobacco or apply cosmetics in areas where there is a potential for exposure to this material. Always wash thoroughly after handling.

EYES: Where eye contact is likely, use chemical splash goggles. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower.

SKIN: Where contact is likely, wear chemical-resistant (such as nitrile or butyl) gloves, coveralls, socks and chemical-resistant footwear. For overhead exposure, wear chemical-resistant headgear.

INHALATION: A respirator is not normally required when handling this substance. Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below exposure limits. A NIOSH-certified combination air-purifying respirator with an N, P or R 95 or HE class filter and an organic vapour cartridge may be permissible under certain circumstances where airborne concentrations are expected to exceed exposure limits. Protection provided by air-purifying respirators is limited. Use a pressure demand atmosphere-supplying respirator if there is any potential for uncontrolled release,

exposure levels are not known, or under any other circumstances where air-purifying respirators may not provide adequate protection.

SECTION – 9: PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Gray viscous suspension.

Formulation Type: Liquid suspension.

Odour: Slight.

pH: 7.5 – 9.5.

Vapour pressure and reference temperature: 5.7×10^{-7} mmHg @ 25 °C (Chlorothalonil Technical).

Vapour density: Not available.

Boiling point: 100 °C.

Melting point: Not applicable.

Freezing point: -5 °C.

Specific gravity or density: 1.28 g/mL.

Evaporation Rate: Not available.

Water/oil partition coefficient: Not available.

Odour threshold: Not available.

Viscosity: 1063 cps @ 20 °C.

Solubility in Water: 0.81 mg/L @ 25 °C (Chlorothalonil Technical).

SECTION – 10: STABILITY AND REACTIVITY

Chemical stability: Stable under normal use and storage conditions.

Conditions to avoid: Unstable under highly alkaline conditions.

Incompatibility with other materials: Metals such as aluminum.

Hazardous decomposition products: Can decompose at high temperatures forming toxic gases.

Hazardous polymerization: Not known to occur.

SECTION – 11: TOXICOLOGICAL INFORMATION

Acute toxicity/Irritation Studies (Finished Product):

Ingestion:	<u>Slightly Toxic</u> Oral (LD50 Rat):	3,750 mg/kg body weight
Dermal:	<u>Slightly Toxic</u> Dermal (LD50 Rabbit):	> 2,000 mg/kg body weight
Inhalation:	<u>Slightly Toxic</u> Inhalation (LC50 Rat):	> 1.96 mg/L air - 4 hours
Eye Contact:	<u>Severely Irritating (Rabbit)</u>	
Skin Contact:	<u>Moderately Irritating (Rabbit)</u>	
Skin Sensitization:	<u>Sensitizer (Guinea Pig)</u>	

Reproductive/Developmental Effects

Chlorothalonil: No evidence of adverse developmental effects in rabbit and rat studies.

Chronic/Subchronic Toxicity Studies

Chlorothalonil: In dogs, 1 years administration caused a significant decrease in body weight gain and increases in absolute liver and kidney weights.

Neurotoxicity: No evidence in regulatory studies.

Carcinogenicity

Chlorothalonil: No evidence of carcinogenicity in dogs after administration for up to one year. Treatment related increases in the incidence of renal tubular adenoma and carcinoma were observed in rats and male mice. Squamous cell adenomas and carcinomas were also observed in the forestomach of both species. However, the forestomach tumors seen in rodent studies are not relevant to human health as humans do not possess an anatomical equivalent of the rodent forestomach. The relevance of renal tumors to human health is unclear. However, metabolism data suggest that the dog, a species that is resistant to chlorothalonil-induced renal injury, may be more representative of humans than the rat. Subsequently, IARC identifies chlorothalonil as a 2B carcinogen (possibly carcinogenic to humans).

Other Toxicity Information:

Studies on rats and mice have suggested that technical chlorothalonil (97%), when fed at high levels in the diet, may have oncogenic potential to these laboratory animals. However, neither chlorothalonil nor its metabolites interact with DNA and thus are not mutagenic. Tumor formation has been related to a non-genotoxic mechanism of action for which threshold levels have been established in rats and mice. Comprehensive dietary and worker exposure studies have shown exposure levels for humans to be well below these threshold levels. In addition, surveillance of chlorothalonil plant workers for over twenty years has not demonstrated any increase in oncogenic potential to humans.

May cause irritation to the respiratory tract. May cause sensitization by skin contact. Exposure of the skin to chlorothalonil may result in weak contact dermatitis.

Toxicity of Other Components

Test results reported in Section 11 for the finished product take into account any acute hazards related to the excipient ingredients in the formulation.

Amorphous Silica

Amorphous Silica is listed as an IARC (Group 3) carcinogen not classifiable as a human carcinogen (No Data Available) with limited animal evidence. Prolonged exposure to amorphous silica may cause damage to respiratory system and irritation to skin and eyes.

Propylene Glycol

Reported to cause central nervous system depression (anesthesia, dizziness, confusion), headache and nausea. Also, eye irritation may occur with lacrimation but no residual discomfort or injury. Prolonged contact to skin may cause mild to moderate irritation and possible allergic reactions. Chronic dietary exposure caused kidney and liver injury in experimental animals.

Other materials that show synergistic toxic effects together with the product: None known.

Target Organs

Active Ingredient

Chlorothalonil: Lung, eye, kidney.

Inert Ingredients

Amorphous Silica: Respiratory tract, skin, eye.
Propylene Glycol: CNS, skin, eye, kidney, liver.

SECTION – 12: ECOLOGICAL INFORMATION

Summary of Effects

Bravo ZN is a fungicide that is mixed with water and applied as a spray for control of plant diseases on potatoes. The active ingredient, chlorothalonil, is practically nontoxic to plants, algae, birds and insects (bees), but is slightly toxic to mammals and highly toxic to fish and aquatic invertebrates (water flea).

Eco-Acute Toxicity

Chlorothalonil:

Green Algae 5-day EC50	0.77 - 210 ppb
Bees LC ₅₀ /EC ₅₀	> 181 µg/bee
Invertebrates (Water Flea) LC ₅₀ /EC ₅₀	> 0.068 ppm
Fish (Trout) LC ₅₀ /EC ₅₀	0.042 ppm
Fish (Bluegill) LC ₅₀ /EC ₅₀	0.065 ppm
Mallard Oral LD ₅₀	> 4640 mg/Kg
Birds (8-day dietary - Bobwhite Quail) LC ₅₀ /EC ₅₀	> 5,200 ppm
Birds (8-day dietary - Mallard Duck) LC ₅₀ /EC ₅₀	> 5,200 ppm

Eco-Chronic Toxicity

Chlorothalonil:

Invertebrates: <i>Daphnia</i> (Water Flea) 21-Day reproduction MATC	0.05 mg/L
Fish: Fathead minnow: 21 Day MATC	0.003-0.0065 mg/L
Fish (Fathead Minnow) 168-day LOEC	6.5 ppb
Bobwhite Quail Reproduction 21-week LOEL	250 ppm
Mallard Duck Reproduction 19-week LOEL	100 ppm

Environmental Fate

The active ingredient, chlorothalonil has a low bioaccumulation potential, and low mobility in soil but is not persistent in soil or water. The dissipation half-life in soil is 10-60 days and in water it is <8 days. Movement in air as vapour is insignificant. The main route of degradation is by microbial degradation and formation of bound residues.

For Bravo Zn, the bulk material sinks in water (after 24 h) and gradually mixes with water to form a suspension.

SECTION – 13: DISPOSAL CONSIDERATIONS

Waste disposal information: Do not reuse empty containers unless they are specifically designed to be refillable.. Empty container retains product residue. Triple rinse, or equivalent, empty container, return rinse water to dilution mixture, and dispose of dilution mixture as a hazardous waste if it cannot be disposed of by use according to label instructions. Dispose of empty containers in accordance with local regulations. Consult provincial environment ministry for advice on waste disposal. Industrial/commercial waste may be handled at licensed facilities only. Waste shipments must be securely packaged and properly labelled. Only licensed carriers may be used, and proper documents must accompany the shipment.

SECTION – 14 : TRANSPORT INFORMATION

Shipping information such as shipping classification:

TRANSPORTATION OF DANGEROUS GOODS CLASSIFICATION - ROAD/RAIL
Not Regulated

SECTION – 15: REGULATORY INFORMATION

WHMIS classification for product: Exempt

A statement that the MSDS has been prepared to meet WHMIS requirements, except for use of the 16 headings.
This MSDS has been prepared in accordance with WHMIS requirements, but the data are presented under 16 headings.

Other regulations; restrictions and prohibitions

Pest Control Products (PCP) Act Registration No.: 28900

SECTION – 16: OTHER INFORMATION

The information contained herein is offered only as a guide to the handling of this specific material and has been prepared in good faith by technically knowledgeable personnel. It is not intended to be all-inclusive and the manner and conditions of use and handling may involve other and additional considerations. No warranty of any kind is given or implied and Syngenta will not be liable for any damages, losses, injuries or consequential damages which may result from the use of or reliance on any information contained herein. This Material Safety Data Sheet is valid for three years. This product is under the jurisdiction of the Pest Control Products Act and is exempt from the requirements for a WHMIS compliant MSDS. Hazardous properties of all ingredients have been considered in the preparation of this MSDS. Read the entire MSDS for the complete hazard evaluation of this product.

Prepared by: Syngenta Crop Protection Canada, Inc.
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