Titan EOS (EOS HERBICIDE by TITAN)

Titan Ag

Chemwatch Hazard Alert Code: **4**

Chemwatch: **37-95901**
Version No: **2.1**
Safety Data Sheet according to Work Health and Safety Regulations (Hazardous Chemicals) 2023 and ADG requirements

Initial Date: **05/05/2026**
Revision Date: **05/05/2026**
Print Date: **29/06/2026**
L.GHS.AUS.EN.E

SECTION 1 Identification of the substance / mixture and of the company / undertaking

Product Identifier

Product name	Titan EOS (EOS HERBICIDE by TITAN)
Chemical Name	Not Applicable
Synonyms	Not Available
Proper shipping name	BIPYRIDILIUM PESTICIDE, LIQUID, TOXIC (contains diquat dibromide and paraquat dichloride)
Chemical formula	Not Applicable
Other means of identification	Not Available

Relevant identified uses of the substance or mixture and uses advised against

Relevant identified uses	Agricultural herbicide. Use according to manufacturer's directions.

Details of the manufacturer or importer of the safety data sheet

Registered company name	**Titan Ag**
Address	Princes Street Marina, Suite 15/16 Princes Street Newport NSW 2106 Australia
Telephone	+61 2 9999 6655
Fax	+61 2 9999 0483
Website	https://www.titanag.com.au/
Email	titanorders@titanag.com.au

Emergency telephone number

Association / Organisation	**Titan Ag**
Emergency telephone number(s)	1800 033 111 (24 hours)
Other emergency telephone number(s)	Not Available

SECTION 2 Hazards identification

Classification of the substance or mixture

Poisons Schedule	S7
Classification [1]	Acute Toxicity (Oral) Category 4, Acute Toxicity (Dermal) Category 4, Skin Corrosion/Irritation Category 2, Sensitisation (Skin) Category 1, Serious Eye Damage/Eye Irritation Category 2A, Acute Toxicity (Inhalation) Category 1, Specific Target Organ Toxicity - Single Exposure (Respiratory Tract Irritation) Category 3, Specific Target Organ Toxicity - Repeated Exposure Category 1, Hazardous to the Aquatic Environment Long-Term Hazard Category 1
Legend:	***1. Classified by Chemwatch; 2. Classification drawn from HCIS; 3. Classification drawn from Regulation (EU) No 1272/2008 - Annex VI***

Label elements

Hazard pictogram(s)	
Signal word	**Danger**

Hazard statement(s)

H302	Harmful if swallowed.
H312	Harmful in contact with skin.
H315	Causes skin irritation.
H317	May cause an allergic skin reaction.
H319	Causes serious eye irritation.
H330	Fatal if inhaled.
H335	May cause respiratory irritation.
H372	Causes damage to organs through prolonged or repeated exposure.
H410	Very toxic to aquatic life with long lasting effects.

Precautionary statement(s) Prevention

P260	Do not breathe mist/vapours/spray.
P271	Use only outdoors or in a well-ventilated area.
P280	Wear protective gloves, protective clothing, eye protection and face protection.
P264	Wash all exposed external body areas thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P273	Avoid release to the environment.
P284	[In case of inadequate ventilation] wear respiratory protection.
P272	Contaminated work clothing should not be allowed out of the workplace.

Precautionary statement(s) Response

P304+P340	IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P310	Immediately call a POISON CENTER/doctor/physician/first aider.
P302+P352	IF ON SKIN: Wash with plenty of water.
P305+P351+P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P333+P313	If skin irritation or rash occurs: Get medical advice/attention.
P337+P313	If eye irritation persists: Get medical advice/attention.
P362+P364	Take off contaminated clothing and wash it before reuse.
P391	Collect spillage.
P301+P312	IF SWALLOWED: Call a POISON CENTER/doctor/physician/first aider if you feel unwell.
P330	Rinse mouth.

Precautionary statement(s) Storage

P403+P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.

Precautionary statement(s) Disposal

P501	Dispose of contents/container to authorised hazardous or special waste collection point in accordance with any local regulation.

No further product hazard information.

SECTION 3 Composition / information on ingredients

Substances

See section below for composition of Mixtures

Mixtures

CAS No	%[weight]	Name
1910-42-5	10-15	paraquat dichloride
85-00-7	5-10	diquat dibromide
Legend:	***1. Classified by Chemwatch; 2. Classification drawn from HCIS; 3. Classification drawn from Regulation (EU) No 1272/2008 - Annex VI; 4. Classification drawn from C&L; * EU IOELVs available***	

SECTION 4 First aid measures

Description of first aid measures

Eye Contact	If this product comes in contact with the eyes: ▸ Immediately hold eyelids apart and flush the eye continuously with running water. ▸ Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids. ▸ Continue flushing until advised to stop by the Poisons Information Centre or a doctor, or for at least 15 minutes. ▸ Transport to hospital or doctor without delay. ▸ Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.
Skin Contact	If skin or hair contact occurs: ▸ Immediately flush body and clothes with large amounts of water, using safety shower if available. ▸ Quickly remove all contaminated clothing, including footwear. ▸ Wash skin and hair with running water. Continue flushing with water until advised to stop by the Poisons Information Centre. ▸ Transport to hospital, or doctor.

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Inhalation	▸ If fumes or combustion products are inhaled remove from contaminated area. ▸ Lay patient down. Keep warm and rested. ▸ Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures. ▸ Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary. ▸ Transport to hospital, or doctor, without delay.
Ingestion	▸ **IF SWALLOWED, REFER FOR MEDICAL ATTENTION, WHERE POSSIBLE, WITHOUT DELAY.** ▸ For advice, contact a Poisons Information Centre or a doctor. ▸ Urgent hospital treatment is likely to be needed. ▸ In the mean time, qualified first-aid personnel should treat the patient following observation and employing supportive measures as indicated by the patient's condition. ▸ If the services of a medical officer or medical doctor are readily available, the patient should be placed in his/her care and a copy of the SDS should be provided. Further action will be the responsibility of the medical specialist. ▸ If medical attention is not available on the worksite or surroundings send the patient to a hospital together with a copy of the SDS. **Where medical attention is not immediately available or where the patient is more than 15 minutes from a hospital or unless instructed otherwise:** ▸ **INDUCE** vomiting with fingers down the back of the throat, **ONLY IF CONSCIOUS**. Lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration. **NOTE:** Wear a protective glove when inducing vomiting by mechanical means.

Indication of any immediate medical attention and special treatment needed

for bipyridilium intoxication, suggested treatment regime for paraquat may be useful, viz:
For ingestion:
- If liquid concentrates (20% or more) have been consumed give promptly large quantities of milk, egg whites, or gelatin solutions. 200 or 500 ml of a 30% suspension of activated charcoal, bentonite or Fuller's earth may be given if protein solutions are not available. Conversely, a slurry of granular household detergent or hand-washing liquid, well diluted with water, will precipitate paraquat (0.1-0.2 gm/kg). Emesis is probably best avoided because of potential mucosal injury and because intense vomiting may occur spontaneously.
- If diluted solutions (2% or less) or granular formulations were swallowed, administer syrup of Ipecac and/or perform gastric lavage. Leave in stomach 200 to 500 ml of 30% suspension of activated charcoal or bentonite, together with 30 gm of magnesium sulfate (Epsom salts). Re-administer the absorbent as often as practical (i.e. every 2 to 4 hours) for several days with magnesium sulfate to sustain diarrhoea.
- Forced diuresis may be necessary.
- Check repeatedly for impending pulmonary oedema.
- Methaemoglobinaemia responds to methylene blue but the drug may precipitate a late haemolytic crisis.
- Steroids may be administered in adrenal cortical failure.
- Monitor for signs of renal, hepatic or cardiac failure and institute appropriate therapies.

For spills on skin:
- Wash thoroughly with soap and water; treat local injury with bland preparations which may contain local anaesthetics, steroids and/or antibiotics.
- If dermal contact produces intoxication refer to therapy above.

For inhalation:
- If exposure is severe, institute therapy as above.

For splashes in the eye:
- Irrigate with water for 10 to 15 minutes.
- Use antibiotics to control infection.
- Consult ophthalmologist.

GOSSELIN, SMITH and HODGE: Clinical Toxicology of Commercial Products.
Fifth Edition, Lippincott, Williams and Wilkins
NOTE: Bipyridilium compounds may be converted, in vivo, to a free radical which, in turn, reacts with molecular oxygen to form toxic intermediates as superoxide ion. Lung lesions have features in common with oxygen poisoning and high oxygen tensions increase paraquat lethality in rats and intensify lung injury.

SECTION 5 Firefighting measures

Extinguishing media

- There is no restriction on the type of extinguisher which may be used.
- Use extinguishing media suitable for surrounding area.

Special hazards arising from the substrate or mixture

Fire Incompatibility	▸ Avoid contamination with oxidising agents i.e. nitrates, oxidising acids, chlorine bleaches, pool chlorine etc. as ignition may result

Advice for firefighters

Fire Fighting	▸ Alert Fire Brigade and tell them location and nature of hazard. ▸ Wear breathing apparatus plus protective gloves in the event of a fire. ▸ Prevent, by any means available, spillage from entering drains or water courses. ▸ Use fire fighting procedures suitable for surrounding area. ▸ **DO NOT** approach containers suspected to be hot. ▸ Cool fire exposed containers with water spray from a protected location. ▸ If safe to do so, remove containers from path of fire. ▸ Equipment should be thoroughly decontaminated after use.
Fire/Explosion Hazard	▸ carbon dioxide (CO_2) hydrogen chloride phosgene nitrogen oxides (NOx) ▸ other pyrolysis products typical of burning organic material. May emit poisonous fumes. May emit corrosive fumes.
HAZCHEM	2X

SECTION 6 Accidental release measures

Personal precautions, protective equipment and emergency procedures

See section 8

Environmental precautions

Continued...

See section 12

Methods and material for containment and cleaning up

Minor Spills	▸ Clean up all spills immediately. ▸ Avoid breathing vapours and contact with skin and eyes. ▸ Control personal contact with the substance, by using protective equipment. ▸ Contain and absorb spill with sand, earth, inert material or vermiculite. ▸ Wipe up. ▸ Place in a suitable, labelled container for waste disposal.
Major Spills	Moderate hazard. ▸ Clear area of personnel and move upwind. ▸ Alert Fire Brigade and tell them location and nature of hazard. ▸ Wear breathing apparatus plus protective gloves. ▸ Prevent, by any means available, spillage from entering drains or water course. ▸ Stop leak if safe to do so. ▸ Contain spill with sand, earth or vermiculite. ▸ Collect recoverable product into labelled containers for recycling. ▸ Neutralise/decontaminate residue (see Section 13 for specific agent). ▸ Collect solid residues and seal in labelled drums for disposal. ▸ Wash area and prevent runoff into drains. ▸ After clean up operations, decontaminate and launder all protective clothing and equipment before storing and re-using. ▸ If contamination of drains or waterways occurs, advise emergency services.

Personal Protective Equipment advice is contained in Section 8 of the SDS.

SECTION 7 Handling and storage

Precautions for safe handling

Safe handling	▸ Avoid skin contact, including inhalation. ▸ Wear protective clothing when risk of exposure occurs. ▸ Use in a well-ventilated area. ▸ Avoid contact with moisture. ▸ Avoid contact with incompatible materials. ▸ When handling, **DO NOT** eat, drink or smoke. ▸ Keep containers securely sealed when not in use. ▸ Avoid physical damage to containers. ▸ Always wash hands with soap and water after handling. ▸ Work clothes should be laundered separately. Launder contaminated clothing before re-use. ▸ Use good occupational work practice. ▸ Observe manufacturer's storage and handling recommendations contained within this SDS. ▸ Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained. ▸ **DO NOT** allow clothing wet with material to stay in contact with skin
Other information	▸ Store in original containers. ▸ Keep containers securely sealed. ▸ Store in a cool, dry, well-ventilated area. ▸ Store away from incompatible materials and foodstuff containers. ▸ Protect containers against physical damage and check regularly for leaks. ▸ Observe manufacturer's storage and handling recommendations contained within this SDS.

Conditions for safe storage, including any incompatibilities

Suitable container	▸ Polyethylene or polypropylene container. ▸ Packing as recommended by manufacturer. ▸ Check all containers are clearly labelled and free from leaks.
Storage incompatibility	▸ Avoid reaction with oxidising agents

SECTION 8 Exposure controls / personal protection

Control parameters

Occupational Exposure Limits (OEL)

INGREDIENT DATA

Source	Ingredient	Material name	TWA	STEL	Peak	Notes
Australia Exposure Standards	diquat dibromide	Diquat	0.5 mg/m3	Not Available	Not Available	Not Available
Australia Workplace exposure limits for airborne contaminants (WEL list) (Effective from 1 December 2026) - Appendix A - Workplace Exposure Limits	diquat dibromide	Diquat (respirable)	0.1 mg/m3	Not Available	Not Available	Not Available
Australia Workplace exposure limits for airborne contaminants (WEL list) (Effective from 1 December 2026) - Appendix A - Workplace Exposure Limits	diquat dibromide	Diquat (inhalable)	0.5 mg/m3	Not Available	Not Available	Not Available

MATERIAL DATA

For paraquat cation:
IDLH Level: 1 mg/m3
Paraquat's high toxicity in the lung is dependent wholly on its particle size. Respirable sizes are from five to six times more toxic than nonrespirable sizes.
Normal paraquat spraying produces aerosols above respirable particle size. Exposure at or below the TLV-TWA is thought to protect the worker against the significant risk of eye, skin and pulmonary irritation; severe lung injury expressed primarily as pulmonary oedema and renal insufficiency.

for diquat
The TLV-TWA is derived by analogy with paraquat and because of the potential for formation of cataracts following exposure to the dust.
Exposure at or below this level is thought to protect against the formation of cataracts and to protect against the significant risk of ocular damage.

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Exposure controls

Appropriate engineering controls

Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection.
The basic types of engineering controls are:
Process controls which involve changing the way a job activity or process is done to reduce the risk.
Enclosure and/or isolation of emission source which keeps a selected hazard "physically" away from the worker and ventilation that strategically "adds" and "removes" air in the work environment. Ventilation can remove or dilute an air contaminant if designed properly. The design of a ventilation system must match the particular process and chemical or contaminant in use.
Employers may need to use multiple types of controls to prevent employee overexposure.

Local exhaust ventilation usually required. If risk of overexposure exists, wear approved respirator. Correct fit is essential to obtain adequate protection. Supplied-air type respirator may be required in special circumstances. Correct fit is essential to ensure adequate protection.
An approved self contained breathing apparatus (SCBA) may be required in some situations.
Provide adequate ventilation in warehouse or closed storage area. Air contaminants generated in the workplace possess varying "escape" velocities which, in turn, determine the "capture velocities" of fresh circulating air required to effectively remove the contaminant.

Type of Contaminant:	Air Speed:
solvent, vapours, degreasing etc., evaporating from tank (in still air).	0.25-0.5 m/s (50-100 f/min.)
aerosols, fumes from pouring operations, intermittent container filling, low speed conveyer transfers, welding, spray drift, plating acid fumes, pickling (released at low velocity into zone of active generation)	0.5-1 m/s (100-200 f/min.)
direct spray, spray painting in shallow booths, drum filling, conveyer loading, crusher dusts, gas discharge (active generation into zone of rapid air motion)	1-2.5 m/s (200-500 f/min.)
grinding, abrasive blasting, tumbling, high speed wheel generated dusts (released at high initial velocity into zone of very high rapid air motion).	2.5-10 m/s (500-2000 f/min.)

Within each range the appropriate value depends on:

Lower end of the range	Upper end of the range
1: Room air currents minimal or favourable to capture	1: Disturbing room air currents
2: Contaminants of low toxicity or of nuisance value only.	2: Contaminants of high toxicity
3: Intermittent, low production.	3: High production, heavy use
4: Large hood or large air mass in motion	4: Small hood-local control only

Simple theory shows that air velocity falls rapidly with distance away from the opening of a simple extraction pipe. Velocity generally decreases with the square of distance from the extraction point (in simple cases). Therefore the air speed at the extraction point should be adjusted, accordingly, after reference to distance from the contaminating source. The air velocity at the extraction fan, for example, should be a minimum of 1-2 m/s (200-400 f/min) for extraction of solvents generated in a tank 2 meters distant from the extraction point. Other mechanical considerations, producing performance deficits within the extraction apparatus, make it essential that theoretical air velocities are multiplied by factors of 10 or more when extraction systems are installed or used.

Individual protection measures, such as personal protective equipment

Eye and face protection

- Safety glasses with side shields.
- Chemical goggles.[AS/NZS 1337.1, EN166 or national equivalent]
- Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lenses or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59].

Skin protection

See Hand protection below

Hands/feet protection

- Wear chemical protective gloves, e.g. PVC.
- Wear safety footwear or safety gumboots, e.g. Rubber

NOTE:

- The material may produce skin sensitisation in predisposed individuals. Care must be taken, when removing gloves and other protective equipment, to avoid all possible skin contact.
- Contaminated leather items, such as shoes, belts and watch-bands should be removed and destroyed.

The selection of suitable gloves does not only depend on the material, but also on further marks of quality which vary from manufacturer to manufacturer. Where the chemical is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application.
The exact break through time for substances has to be obtained from the manufacturer of the protective gloves and has to be observed when making a final choice.
Personal hygiene is a key element of effective hand care. Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturiser is recommended.
Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include:
· frequency and duration of contact,
· chemical resistance of glove material,
· glove thickness and
· dexterity
Select gloves tested to a relevant standard (e.g. Europe EN 374, US F739, AS/NZS 2161.1 or national equivalent).
· When prolonged or frequently repeated contact may occur, a glove with a protection class of 5 or higher (breakthrough time greater than 240 minutes according to EN 374, AS/NZS 2161.10.1 or national equivalent) is recommended.
· When only brief contact is expected, a glove with a protection class of 3 or higher (breakthrough time greater than 60 minutes according to EN 374, AS/NZS 2161.10.1 or national equivalent) is recommended.
· Some glove polymer types are less affected by movement and this should be taken into account when considering gloves for long-term use.
· Contaminated gloves should be replaced.
As defined in ASTM F-739-96 in any application, gloves are rated as:
· Excellent when breakthrough time > 480 min
· Good when breakthrough time > 20 min
· Fair when breakthrough time < 20 min

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	· Poor when glove material degrades For general applications, gloves with a thickness typically greater than 0.35 mm, are recommended. It should be emphasised that glove thickness is not necessarily a good predictor of glove resistance to a specific chemical, as the permeation efficiency of the glove will be dependent on the exact composition of the glove material. Therefore, glove selection should also be based on consideration of the task requirements and knowledge of breakthrough times. Glove thickness may also vary depending on the glove manufacturer, the glove type and the glove model. Therefore, the manufacturers technical data should always be taken into account to ensure selection of the most appropriate glove for the task. Note: Depending on the activity being conducted, gloves of varying thickness may be required for specific tasks. For example: · Thinner gloves (down to 0.1 mm or less) may be required where a high degree of manual dexterity is needed. However, these gloves are only likely to give short duration protection and would normally be just for single use applications, then disposed of. · Thicker gloves (up to 3 mm or more) may be required where there is a mechanical (as well as a chemical) risk i.e. where there is abrasion or puncture potential Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturiser is recommended.
Body protection	See Other protection below
Other protection	▸ Overalls. ▸ P.V.C apron. ▸ Barrier cream. ▸ Skin cleansing cream. ▸ Eye wash unit.

Respiratory protection

Full face respirator with supplied air.

Where the concentration of gas/particulates in the breathing zone, approaches or exceeds the "Exposure Standard" (or ES), respiratory protection is required.
Degree of protection varies with both face-piece and Class of filter; the nature of protection varies with Type of filter.

Required Minimum Protection Factor	Half-Face Respirator	Full-Face Respirator	Powered Air Respirator
up to 10 x ES	A-AUS P2	-	A-PAPR-AUS / Class 1 P2
up to 50 x ES	-	A-AUS / Class 1 P2	-
up to 100 x ES	-	A-2 P2	A-PAPR-2 P2 ^

^ - Full-face
A(All classes) = Organic vapours, B AUS or B1 = Acid gasses, B2 = Acid gas or hydrogen cyanide(HCN), B3 = Acid gas or hydrogen cyanide(HCN), E = Sulfur dioxide(SO2), G = Agricultural chemicals, K = Ammonia(NH3), Hg = Mercury, NO = Oxides of nitrogen, MB = Methyl bromide, AX = Low boiling point organic compounds(below 65 degC)

- Cartridge respirators should never be used for emergency ingress or in areas of unknown vapour concentrations or oxygen content.
- The wearer must be warned to leave the contaminated area immediately on detecting any odours through the respirator. The odour may indicate that the mask is not functioning properly, that the vapour concentration is too high, or that the mask is not properly fitted. Because of these limitations, only restricted use of cartridge respirators is considered appropriate.
- Cartridge performance is affected by humidity. Cartridges should be changed after 2 hr of continuous use unless it is determined that the humidity is less than 75%, in which case, cartridges can be used for 4 hr. Used cartridges should be discarded daily, regardless of the length of time used

SECTION 9 Physical and chemical properties

Information on basic physical and chemical properties

Appearance	Dark green to blue liquid.

Physical state	Liquid	**Relative density (Water = 1)**	~1.16
Odour	Characteristic	**Partition coefficient n-octanol / water**	Not Available
Odour threshold	Not Available	**Auto-ignition temperature (°C)**	Not Applicable
pH (as supplied)	Not Available	**Decomposition temperature (°C)**	Not Available
Melting point / freezing point (°C)	Not Available	**Viscosity (cSt)**	Not Available
Initial boiling point and boiling range (°C)	~100	**Molecular weight (g/mol)**	Not Applicable
Flash point (°C)	Not Applicable	**Taste**	Not Available
Evaporation rate	Not Available	**Explosive properties**	Not Available
Flammability	Not Applicable	**Oxidising properties**	Not Available
Upper Explosive Limit (%)	Not Available	**Surface Tension (dyn/cm or mN/m)**	Not Available
Lower Explosive Limit (%)	Not Available	**Volatile Component (%vol)**	Not Available
Vapour pressure (kPa)	2.37	**Gas group**	Not Available
Solubility in water	Miscible	**pH as a solution (1%)**	5-6.5
Vapour density (Air = 1)	Not Available	**VOC g/L**	Not Available
Heat of Combustion (kJ/g)	Not Available	**Ignition Distance (cm)**	Not Available
Flame Height (cm)	Not Available	**Flame Duration (s)**	Not Available
Enclosed Space Ignition Time Equivalent (s/m3)	Not Available	**Enclosed Space Ignition Deflagration Density (g/m3)**	Not Available

SECTION 10 Stability and reactivity

Reactivity	See section 7
Chemical stability	▸ Unstable in the presence of incompatible materials. ▸ Product is considered stable. ▸ Hazardous polymerisation will not occur.

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Possibility of hazardous reactions	See section 7
Conditions to avoid	See section 7
Incompatible materials	See section 7
Hazardous decomposition products	See section 5

SECTION 11 Toxicological information

Information on toxicological effects

a) Acute Toxicity	There is sufficient evidence to classify this material as acutely toxic.
b) Skin Irritation/Corrosion	There is sufficient evidence to classify this material as skin corrosive or irritating.
c) Serious Eye Damage/Irritation	There is sufficient evidence to classify this material as eye damaging or irritating
d) Respiratory or Skin sensitisation	There is sufficient evidence to classify this material as sensitising to skin or the respiratory system
e) Mutagenicity	Based on available data, the classification criteria are not met.
f) Carcinogenicity	Based on available data, the classification criteria are not met.
g) Reproductivity	Based on available data, the classification criteria are not met.
h) STOT - Single Exposure	There is sufficient evidence to classify this material as toxic to specific organs through single exposure
i) STOT - Repeated Exposure	There is sufficient evidence to classify this material as toxic to specific organs through repeated exposure
j) Aspiration Hazard	Based on available data, the classification criteria are not met.

Inhaled	Inhalation of vapours or aerosols (mists, fumes), generated by the material during the course of normal handling, may produce severely toxic effects; these may be fatal. Strong evidence exists that exposure to the material may produce very serious irreversible damage (other than carcinogenesis, mutagenesis and teratogenesis) following a single exposure by inhalation. Evidence shows, or practical experience predicts, that the material produces irritation of the respiratory system, in a substantial number of individuals, following inhalation. In contrast to most organs, the lung is able to respond to a chemical insult by first removing or neutralising the irritant and then repairing the damage. The repair process, which initially evolved to protect mammalian lungs from foreign matter and antigens, may however, produce further lung damage resulting in the impairment of gas exchange, the primary function of the lungs. Respiratory tract irritation often results in an inflammatory response involving the recruitment and activation of many cell types, mainly derived from the vascular system. Inhalation of vapours may cause drowsiness and dizziness. This may be accompanied by narcosis, reduced alertness, loss of reflexes, lack of coordination and vertigo. Inhalation of mists, dusts or vapours containing bipyridyliums may produce respiratory irritation with coughing, dyspnea, nosebleed, and pulmonary oedema. Other symptoms may include pulmonary alveolar cell necrosis, followed by connective tissue proliferation and pulmonary fibrosis (characteristic of paraquat intoxications). Intratracheal administration in rats produces initial alveolar damage which develops into lung fibrosis. Paraquat (another bipyridyl pesticide) on a weight basis is more effective in producing this effect because it is more actively taken up by lung tissue. Male and female rats exposed to respirable aerosols (2 mg/m3 for 15 daily, 6-hour/day exposure) over a three week period remained in good condition. Histopathology showed peribronchial lymphoid hyperplasia, slight perivascular oedema, and an excess of macrophages in the alveoli. No effects are seen rats exposed to 0.5 mg/m3. In another study rats exposed aerosols where the mean aerodynamic diameter was 1.8 um (6 hours/day, 5 days/week for 3-weeks) showed concentration dependant abnormal respiratory sounds, decreased food consumption and body weight, increased lung weight and histopathologic changes in lungs. Exposure-related effects appeared reversible. A no-adverse-effect-level of 0.097 mg cation/m3 was subsequently established Inhalation of dusts, generated by the material, during the course of normal handling, may produce severely toxic effects; these may be fatal.
Ingestion	Strong evidence exists that exposure to the material may produce very serious irreversible damage (other than carcinogenesis, mutagenesis and teratogenesis) following a single exposure by swallowing. Bipyridylium quaternary ammonium compounds (also known as dipyridyliums, bipyridiniums, viologens), as represented by the cationic herbicides paraquat and diquat, are strongly cationic in aqueous solution and may produce severe corrosive damage following ingestion. In addition, they may be extremely potent systemic toxins following absorption and may cause multiple system organ damage including liver and kidney injury. Death results from pulmonary oedema, cardiac damage, cardiovascular and circulatory collapse, and cerebral haemorrhage/ infarctions. Reaction with bipyridylium di-cations and NADPH produces highly reactive free radicals, leading to tissue destruction through lipid peroxidation. Symptoms of overexposure include hypotension and arrhythmias, coughing, dyspnea, nosebleed (epistaxis), headache, lethargy, central nervous system (CNS) depression and coma. Other symptoms may include pulmonary alveolar cell necrosis, followed by connective tissue proliferation and pulmonary fibrosis (characteristic of paraquat intoxications), cerebral and brain stem haemorrhagic infarctions (characteristic of diquat intoxications), gastrointestinal fluid sequestration and renal failure. Cyanosis may be due to anoxic hypoxia or methaemoglobinaemia. Ingestion of concentrated solutions may produce swelling in the mouth and throat and oral ulceration. Nausea, vomiting, and a burning pain in the mouth, pharynx, oesophagus and abdomen, profuse, bloody vomiting (haematemesis), paralytic ileus and diarrhoea with bloody stools, may also result. The severity and tempo of the onset of symptoms depend on the dose with severe exposures leading to corrosive gastrointestinal damage, rapid onset of renal failure (resulting from massive fluid and electrolyte loss), muscle damage (myonecrosis), shock and death within hours or days. Lesser exposures may produce a more indolent response evolving over several days. Symptoms such as sore throat and dysphagia may occur within 24 hours; excoriated lips, and ulcers of the tongue, buccal mucosa and the pharynx may also be evident. Kidney damage (acute renal failure) may occur within 1 to 6 days; signs include oliguria, proteinuria, glucosuria and aminoaciduria. Signs of adrenal cortical necrosis may include fever, abdominal pain, lethargy, somnolence, and hypovolaemic vascular shock. Signs of liver damage (hepatotoxicity) may include pain in the upper quadrant due to enlargement and tenderness and jaundice. Signs of toxic myocarditis or signs of pulmonary congestion and early pulmonary oedema may or may not reflect acute cardiac failure. Recovery is generally complete in survivors, although pulmonary function tests may remain abnormal for months. Decreased pulmonary function may be evident form generalised rales, reduced arterial oxygen saturation, cyanosis, restriction in lung volume, increasing alveolar-arterial oxygen tension gradient, intrapulmonary shunt, and granular changes in X-rays of the lung fields. There may be an occasionally persistent anaemia due to selective erythropoiesis in the bone marrow. Diquat ingestion has produced fatalities in humans. Massive oral doses causing a generalised necrosis, mainly of the heart, liver and kidneys with death occurring within a few hours to several days. Lesser doses give rise (sometimes with 24-48 hour asymptomatic period) to a profound decrease of circulating body fluids (hypovolaemia), secondary to gastrointestinal tract fluid sequestration, acute tubular necrosis and haemorrhagic central nervous system lesions. Large oral doses administered to rats produced distension and thickening of the pulmonary alveolar walls. For the first 24 hours after oral administration of a lethal dose of diquat there are few symptoms in animals. Lethargy, respiratory difficulty, lost weight and weakness eventually develop with death between 2 and 14 days after administration.. In male rats an LD50 quantity produces a rapid accumulation of

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	water in the lumen of the gastro-intestinal tract of all animals. The accumulation reaches a maximum at 24 hours and other tissues, especially the blood, become dehydrated Severely toxic effects may result from the accidental ingestion of the material; animal experiments indicate that ingestion of less than 5 gram may be fatal or may produce serious damage to the health of the individual.
Skin Contact	Skin contact with the material may produce toxic effects; systemic effects may result following absorption. Evidence exists, or practical experience predicts, that the material either produces inflammation of the skin in a substantial number of individuals following direct contact, and/or produces significant inflammation when applied to the healthy intact skin of animals, for up to four hours, such inflammation being present twenty-four hours or more after the end of the exposure period. Skin irritation may also be present after prolonged or repeated exposure; this may result in a form of contact dermatitis (nonallergic). The dermatitis is often characterised by skin redness (erythema) and swelling (oedema) which may progress to blistering (vesiculation), scaling and thickening of the epidermis. At the microscopic level there may be intercellular oedema of the spongy layer of the skin (spongiosis) and intracellular oedema of the epidermis. Strong evidence exists that exposure to the material may produce very serious irreversible damage (other than carcinogenesis, mutagenesis and teratogenesis) following a single exposure by skin contact. The material may accentuate any pre-existing dermatitis condition Direct skin contact with bipyridylium compounds may produce irritation, dryness, erythema, blistering, ulceration, and nail changes (transverse ridging, furrowing). Irritant or contact dermatitis may also occur. Cyanosis with jaundice may result following absorption or entry through wounds or lesions. Repeated exposures may result in severe skin irritation, blistering and excoriation. Contact with diquat may cause a delay in healing of cuts and wounds.
Eye	When applied to the eye(s) of animals, the material produces severe ocular lesions which are present twenty-four hours or more after instillation. Direct eye contact with bipyridylium compounds may produce chemical conjunctivitis and severe eye injury resembling corrosive injuries. Permanent corneal scarring is possible. Severe inflammation may be evident, reaching a maximum intensity in 12 to 24 hours. Loss of corneal epithelium and the superficial layers of the cornea may occur early. Recovery is generally complete given proper care. Systemic signs have not been reported from this route of exposure.
Chronic	Long-term exposure to respiratory irritants may result in disease of the airways involving difficult breathing and related systemic problems. Practical experience shows that skin contact with the material is capable either of inducing a sensitisation reaction in a substantial number of individuals, and/or of producing a positive response in experimental animals. Substances that can cause occupational asthma (also known as asthmagens and respiratory sensitisers) can induce a state of specific airway hyper-responsiveness via an immunological, irritant or other mechanism. Once the airways have become hyper-responsive, further exposure to the substance, sometimes even to tiny quantities, may cause respiratory symptoms. These symptoms can range in severity from a runny nose to asthma. Not all workers who are exposed to a sensitiser will become hyper-responsive and it is impossible to identify in advance who are likely to become hyper-responsive. Substances than can cuase occupational asthma should be distinguished from substances which may trigger the symptoms of asthma in people with pre-existing air-way hyper-responsiveness. The latter substances are not classified as asthmagens or respiratory sensitisers Wherever it is reasonably practicable, exposure to substances that can cuase occupational asthma should be prevented. Where this is not possible the primary aim is to apply adequate standards of control to prevent workers from becoming hyper-responsive. Activities giving rise to short-term peak concentrations should receive particular attention when risk management is being considered. Health surveillance is appropriate for all employees exposed or liable to be exposed to a substance which may cause occupational asthma and there should be appropriate consultation with an occupational health professional over the degree of risk and level of surveillance. Toxic: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed. Serious damage (clear functional disturbance or morphological change which may have toxicological significance) is likely to be caused by repeated or prolonged exposure. As a rule the material produces, or contains a substance which produces severe lesions. Such damage may become apparent following direct application in subchronic (90 day) toxicity studies or following sub-acute (28 day) or chronic (two-year) toxicity tests. Exposure to the material may cause concerns for human fertility, generally on the basis that results in animal studies provide sufficient evidence to cause a strong suspicion of impaired fertility in the absence of toxic effects, or evidence of impaired fertility occurring at around the same dose levels as other toxic effects, but which are not a secondary non-specific consequence of other toxic effects. Exposure to the material may cause concerns for humans owing to possible developmental toxic effects, generally on the basis that results in appropriate animal studies provide strong suspicion of developmental toxicity in the absence of signs of marked maternal toxicity, or at around the same dose levels as other toxic effects but which are not a secondary non-specific consequence of other toxic effects. Limited evidence suggests that repeated or long-term occupational exposure may produce cumulative health effects involving organs or biochemical systems. Chronic poisoning from ionic bromides has historically resulted from medical use of bromides but not from exposure in the environment or workplace. In the absence of other signs of poisoning, there may be depression, hallucinations and schizophrenia-like psychosis. Bromides may also cause sedation, irritability, agitation, delirium, memory loss, confusion, disorientation, forgetfulness, inability to speak, difficulty speaking, weakness, fatigue, a spinning sensation, stupor, coma, decreased appetite, nausea, vomiting, an acne-like rash on the face (bronchoderma), legs and trunk, swelling of the bronchi and a profuse discharge from the nostrils. There may also be inco-ordination and very brisk reflexes. Correlation of nervous system symptoms with blood levels of bromide is inexact. Current day usage of bromides is generally limited to antihistamines such as brompheniramine, which is a covalent compound; ionic compounds are no longer regularly used due to their toxicity. In test animals, brominated vegetable oils (BVOs), historically used as emulsifiers in certain soda-based soft drinks, produced damage to the heart and kidneys in addition to increasing fat deposits in these organs. In extreme cases, BVOs caused testicular damage, stunted growth and produced lethargy and fatigue. Brominism (chronic bromine poisoning) produces slurred speech, apathy, headache, decreased memory, anorexia and drowsiness, psychosis resembling paranoid schizophrenia, and personality changes. Several cases of foetal abnormalities have been described in mothers who took large doses of bromides during pregnancy. Reproductive effects caused by bromide (which crosses the placenta) include central nervous system depression, brominism, and bronchoderma (an acne-like rash) in the newborn. Diquat is considered to be acutely toxic but have low cumulative toxicity. In test animals diquat has caused bilateral cataract. Functional liver and kidney changes are expected to be mild. Persons with chronic diseases of the central nervous system, liver, heart, kidneys, lungs and skin, as well as endocrinological or immunological disturbances should not be exposed to herbicides. [CHRIS/ILO Encyclopaedia] Chronic administration to rats and dogs produced cataracts. A clear dose-response relationship was established. At dietary levels of 1000 ppm for two years complete opacities appeared in one or both lenses within 6-months. In a separate rat study the NOEL for cataracts was 5 ppm (0.22 mg/kg/day). Prolonged exposure to diquat is necessary to produce cataracts

Titan EOS (EOS HERBICIDE by TITAN)	**TOXICITY**	**IRRITATION**
	Not Available	Not Available

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paraquat dichloride	**TOXICITY**	**IRRITATION**
	dermal (rat) LD50: 80 mg/kg[2]	Eye (Rodent - rabbit): 12500ug - Severe
	Inhalation (Rat) LC50: <0.001 mg/L4h[1]	Eye (Rodent - rabbit): 25mg - Mild
	Oral (Guinea) LD50; 22 mg/kg[2]	Eye: adverse effect observed (irritating)[1]
		Skin: no adverse effect observed (not irritating)[1]
diquat dibromide	**TOXICITY**	**IRRITATION**
	dermal (rat) LD50: 433 mg/kg[2]	Eye (Rodent - rabbit): 10mg - Mild
	Inhalation (Rat) LC50: 0.121 mg/l4h[1]	Eye: adverse effect observed (irritating)[1]
	Oral (Mouse) LD50; 68 mg/kg[2]	Skin (Rodent - rabbit): 400mg/20D - Mild
		Skin: adverse effect observed (irritating)[1]

Legend:	***1. Value obtained from Europe ECHA Registered Substances - Acute toxicity 2. Value obtained from manufacturer's SDS. Unless otherwise specified data extracted from RTECS - Register of Toxic Effect of chemical Substances***

PARAQUAT DICHLORIDE	Changed recordings from specific areas of brain and coverings, somnolence, convulsions, excitement, emphysema, interstitial fibrosis, acute pulmonary oedema, chronic pulmonary oedema, dyspnea, respiratory stimulation, ulceration and bleeding of the stomach, diarrhoea, nausea, vomiting, liver changes, gastrointestinal and liver changes, changes in kidney tubules and glomeruli) decreased urine volume, cutaneous sensitisation after topical application, effects on fertility, specific developmental (musculoskeletal system) recorded. The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.
DIQUAT DIBROMIDE	for diquat bromide: **Acute toxicity:** Diquat dibromide is a moderately toxic chemical . It may be fatal to humans if swallowed, inhaled, or absorbed through the skin . Concentrated solutions may cause severe irritation of the mouth, throat, esophagus and stomach followed by nausea, vomiting, diarrhea, severe drying out of bodily tissues, gastrointestinal discomfort, chest pain, diarrhea, kidney failure, and toxic liver damage. Very large doses of the herbicide can result in convulsions and tremors. Rats given lethal doses of diquat showed few signs of illness during the first 24 hours. They then exhibited lethargy, pupil dilation, respiratory distress, weight loss weakness and finally death over the course of 2 to 14 days after dosing. Similar patterns of symptoms occurred in mice, guinea pigs, rabbits, dogs, cows and hens. Diquat dibromide is acutely toxic when it is absorbed through the skin and the possibility for poisoning increases with repeated exposure. Dermal adsorption is higher where the skin is cut or abraded. Although absorption is reportedly low following dermal exposure, the demonstrated toxicity of this compound is sufficient to raise serious human health concerns. Small amounts of diquat can cause skin irritation and sores, as well as delayed healing of cuts and wounds . When absorbed through the skin, some commercial concentrate formulations of diquat can cause symptoms similar to those that occur when it is eaten. There have been reports of workers who have had softening and color changes in one or more fingernails after contact with concentrated diquat dibromide solutions. In some instances, the nail was shed, and did not grow in again . A single dose of diquat was not irritating to the skin of rabbits. Repeated dermal doses cause mild redness, thickening, and scabbing . Diquat dibromide also causes eye irritation . Several cases of severe injury to human eyes have been reported after accidental splashings. In each case, initial irritation was mild, but after several days, serious burns and sometimes scarring of the cornea developed . Moderate to severe membrane irritation occurred when diquat was put in the eyes of rabbits. Direct or excessive inhalation of diquat dibromide spray mist or dust may result in oral or nasal irritation, nosebleeds, headache, sore throat, coughing, and symptoms similar to those from ingestion of diquat . The oral LD50 for diquat in rats is 120 mg/kg, 233 mg/kg in mice, 188 mg/kg in rabbits, 187 mg/kg in guinea pigs and dogs. Cows appear to be particularly sensitive to this herbicide, with an oral LD50 of 30 to 56 mg/kg . The acute dermal LD50 for diquat dibromide is 250-400 mg/kg in rabbits. **Chronic toxicity:** Cataract formation is the most significant effect of chronic exposure to diquat that is currently recognised. Cataracts, a clouding of the eyes which interferes with light entering the eye, occurred in rats and dogs given 2.5 mg/kg and 5 mg/kg of diquat, respectively. The number of cases of cataracts increased in test animals (cats and dogs) as the amount of diquat was increased in their diets. This is referred to as a dose-dependent association between cataracts and diquat ingestion. A single, near-fatal dose will not produce cataracts. Chronic exposure is necessary. The effects of repeated, or prolonged, dermal contact with diquat dibromide range from inflammation of the skin, to general bodily ('systemic') poisoning, as evidenced by injury to internal organs, primarily the kidneys. Chronic exposure may damage skin, which allows more absorption of the herbicide. Repeated applications of 42 mg/kg of diquat killed four out of six rabbits tested. While rats fed 50 mg/kg of diquat for two years did not die from testing, their food intake and growth was decreased. Repeated inhalation exposure of rats to 1.9 mg/m3 caused inflammatory changes in connective tissues, damage to the kidneys and heart, abnormal levels of several liver enzymes, low white blood cell counts, high red blood cell counts, and depressed cholinesterase activity. **Reproductive Effects:** Diquat dibromide does not cause reproductive effects. It did not reduce fertility when tested in experimental animals. Rats receiving 25 mg/kg decreased their food intake and showed slowed growth, but had unchanged reproduction. Fertility was reduced in male mice given diquat dibromide during different stages of sperm formation. Neither fertility nor reproduction was affected in a three-generation study in rats given dietary doses of 0, 12.5 or 25 mg/kg/day of diquat dibromide, although some growth retardation was seen at the 25 mg/kg/day dose. **Teratogenic Effects:** EPA does not consider diquat capable of causing teratogenic effects. However, diquat dibromide is thought by other researchers to have the potential to cause birth defects. It is referred to as an experimental teratogen based on a study which showed teratogenic effects in six-day pregnant rats given intravenous injections of diquat. A lowest published toxic dose, or TDLo, of 7 mg/kg resulted from this study. Growth retardation was seen in test animals given extremely high doses of diquat. No deformities were found in the unborn offspring of pregnant rats that were injected intraperitoneally with 0.5 mg/kg of diquat daily during organogenesis, the stage of fetal development in which organs are formed. Pregnant rats died when they were injected with 14 mg/kg of diquat dibromide. Upon examination of the unborn rats, there was evidence of skeletal defects of the collar bone, as well as little or no ear bone formation. While no actual teratogenesis occurred in rats given single abdominal injections during the 7th to 14th days of pregnancy, many rats did not have normal weight gain and bone formation in the unborn was decreased. **Mutagenic Effects:** U.S. EPA has required more testing on the capability of this herbicide to cause mutations, since available information is contradictory. Diquat dibromide is not known to cause permanent changes in genetic material and is therefore not considered a mutagen. No mutagenic effects were seen in mice given ten mg/kg of diquat orally for five day. **Carcinogenic Effects:** Diquat dibromide is not classified as a tumour-causing chemical. An 80-week feeding study showed that dietary doses of 15 mg/kg/day of diquat did not cause tumors in rats. Likewise, dietary levels of 36 mg/kg/day for two years did not induce tumors in rats. **Organ Toxicity:** Based on records of suicidal ingestion of diquat by humans as well as diquat-feeding studies of monkeys, it has been concluded that diquat is most harmful to the gastrointestinal tract (GIT), kidneys, and liver. Severe congestion and ulceration of the stomach and bowel are produced by the herbicide. After large doses of diquat are given, there is evidence of stretching and irritation of the GIT and thickening of the walls of the alveoli, or air cells of the lungs . When enough diquat is given, the fat in the liver goes through extreme changes. Acute death occurs in the cells of the small glandular tubes that process urine in the kidney. Cataracts are caused when smaller amounts of diquat are given. While diquat dibromide appears to primarily affect the tissue lining of the eye lens and the kidneys, water is apparently removed from other tissues as well. Dehydration can result. The amount of water which is removed depends on how much diquat dibromide is given. Poisoning by diquat may affect the liver and kidneys.

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	Fate in humans and animals: Diquat dibromide may be absorbed by humans following oral ingestion, dermal exposure or inhalation of spray mists. Studies indicate that absorption from the gut into the bloodstream is low. Oral doses of diquat are metabolized mainly within the intestines rather than in the body proper, with metabolites being excreted in the feces. Only a small percentage of oral doses are absorbed into the bloodstream and then excreted in the urine. When rats were fed radio labeled diquat, only 6% of the dose was recovered in the urine. When exposure occurs through routes other than oral, diquat enters the bloodstream and is rapidly eliminated in the urine. Following subcutaneous injection in rats, excretion of about 90% of the dose occurred in the urine on the first day and almost all of the remainder on the next day. Complete elimination of the herbicide was seen in urine and feces of rats within four days of administration of oral doses of five to ten mg/kg of diquat dibromide. When diquat was fed to hens, 70- 80% was unchanged when it was excreted in the faeces. In cattle 0.004 to 0.015% of an oral dose was recovered in the milk and 0.4 to 2.6% of the dose was found in the urine. The material may be irritating to the eye, with prolonged contact causing inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis. The material may cause skin irritation after prolonged or repeated exposure and may produce on contact skin redness, swelling, the production of vesicles, scaling and thickening of the skin.
Titan EOS (EOS HERBICIDE by TITAN) & DIQUAT DIBROMIDE	The following information refers to contact allergens as a group and may not be specific to this product. Contact allergies quickly manifest themselves as contact eczema, more rarely as urticaria or Quincke's oedema. The pathogenesis of contact eczema involves a cell-mediated (T lymphocytes) immune reaction of the delayed type. Other allergic skin reactions, e.g. contact urticaria, involve antibody-mediated immune reactions. The significance of the contact allergen is not simply determined by its sensitisation potential: the distribution of the substance and the opportunities for contact with it are equally important. A weakly sensitising substance which is widely distributed can be a more important allergen than one with stronger sensitising potential with which few individuals come into contact. From a clinical point of view, substances are noteworthy if they produce an allergic test reaction in more than 1% of the persons tested.
Titan EOS (EOS HERBICIDE by TITAN) & PARAQUAT DICHLORIDE & DIQUAT DIBROMIDE	Asthma-like symptoms may continue for months or even years after exposure to the material ends. This may be due to a non-allergic condition known as reactive airways dysfunction syndrome (RADS) which can occur after exposure to high levels of highly irritating compound. Main criteria for diagnosing RADS include the absence of previous airways disease in a non-atopic individual, with sudden onset of persistent asthma-like symptoms within minutes to hours of a documented exposure to the irritant. Other criteria for diagnosis of RADS include a reversible airflow pattern on lung function tests, moderate to severe bronchial hyperreactivity on methacholine challenge testing, and the lack of minimal lymphocytic inflammation, without eosinophilia. RADS (or asthma) following an irritating inhalation is an infrequent disorder with rates related to the concentration of and duration of exposure to the irritating substance. On the other hand, industrial bronchitis is a disorder that occurs as a result of exposure due to high concentrations of irritating substance (often particles) and is completely reversible after exposure ceases. The disorder is characterized by difficulty breathing, cough and mucus production.

Acute Toxicity	✔	**Carcinogenicity**	✘
Skin Irritation/Corrosion	✔	**Reproductivity**	✘
Serious Eye Damage/Irritation	✔	**STOT - Single Exposure**	✔
Respiratory or Skin sensitisation	✔	**STOT - Repeated Exposure**	✔
Mutagenicity	✘	**Aspiration Hazard**	✘

Legend: ✘ ***– Data either not available or does not fill the criteria for classification***
✔ ***– Data available to make classification***

SECTION 12 Ecological information

Toxicity

Titan EOS (EOS HERBICIDE by TITAN)	**Endpoint**	**Test Duration (hr)**	**Species**	**Value**	**Source**
	Not Available	Not Available	Not Available	Not Available	Not Available

paraquat dichloride	**Endpoint**	**Test Duration (hr)**	**Species**	**Value**	**Source**
	EC50	72h	Algae or other aquatic plants	0.01-0.09mg/L	4
	BCF	1008h	Fish	<0.2-0.3	7
	EC50	48h	Crustacea	0.128-0.18mg/L	4
	EC50	96h	Algae or other aquatic plants	<0.001mg/L	2
	NOEC(ECx)	96h	Algae or other aquatic plants	<0.001mg/L	2
	LC50	96h	Fish	5.13-27.31mg/l	4

diquat dibromide	**Endpoint**	**Test Duration (hr)**	**Species**	**Value**	**Source**
	BCF	1008h	Fish	<0.6-1.4	7
	EC50	72h	Algae or other aquatic plants	0.002mg/L	2
	EC50	48h	Crustacea	0.826-1.156mg/L	4
	EC50	96h	Algae or other aquatic plants	0.002-0.007mg/L	4
	LC50	96h	Fish	0.29-0.86mg/L	4
	NOEC(ECx)	336h	Algae or other aquatic plants	<0.001mg/L	4

Legend:	***Extracted from 1. IUCLID Toxicity Data 2. Europe ECHA Registered Substances - Ecotoxicological Information - Aquatic Toxicity 3. US EPA, Ecotox database - Aquatic Toxicity Data 4. ECETOC Aquatic Hazard Assessment Data 5. NITE (Japan) - Bioconcentration Data 6. METI (Japan) - Bioconcentration Data 7. Vendor Data***

Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
Do NOT allow product to come in contact with surface waters or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment or disposing of equipment wash-waters.
Wastes resulting from use of the product must be disposed of on site or at approved waste sites.
for diquat bromide:

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Environmental fate:
Breakdown of Chemical in Soil and Groundwater: When diquat dibromide comes in contact with soil, it becomes strongly adsorbed to clay particles or organic matter in the soil for long periods of time (Koc - 100,000 g/ml). The strong chemical bonds formed by diquat adsorption to soil particles make the herbicide biologically and chemically inactive. That is, in certain soils it is unlikely to be:

- carried away, or leached, by water seeping through the soil;
- taken up by plants;
- broken down by microbes in the soil in a process called microbial degradation; or
- broken down by sunlight (photochemical degradation).

Traces, or residues, of diquat have been found to persist in soil for many years with very little degradation
Soil capacity for adsorption of diquat is so high in comparison to the rates at which it is applied that there is little possibility that leaching or groundwater contamination will occur. Field and laboratory tests show that diquat usually remains in the top inch of soil for long periods of time after it is applied. However, there is also evidence that diquat has the ability to eventually use up, or saturate, all the available adsorption sites on soil clay particles. Groundwater quality can be affected if soil adsorption sites become totally saturated because water moving down through the soil can carry any non adsorbed herbicide into the groundwater. More research is needed for a better understanding of the potential effects on groundwater of long- term, repeated use of diquat.
Studies on the erosion of diquat-treated soils near bodies of water indicate that diquat stays bonded to soil particles, remaining biologically inactive in surface waters, such as lakes, rivers and ponds.
Breakdown of Chemical in Water: Since diquat is purposely applied to water to control the growth of aquatic weeds, its ability to last as an effective residue has been studied carefully. These studies suggest that diquat is not persistent in water. When diquat is applied to open water, it disappears rapidly because it binds to suspended particles in the water. These particles are then taken up by plants. Diquat dibromide's half-life, or the period of time that it usually takes for half of the amount of the material to be broken down by natural processes, is less than 48 hours in water. As affected plants decompose, the adsorbed diquat rapidly disappears from open waters. Disappearance may be due to degradation by microbes or sunlight, or due to adsorption to bottom sediments. Twenty-two days after a weed infested artificial lake was treated, only 1% of the applied diquat remained in the water and 19% was adsorbed to sediments. Adsorbed diquat was subject to microbial degradation. Diquat has been found in the bottom soil of pools and ponds four years after application. Diquat will photodegrade in surface layers of water in 1 to 3 or more weeks when it is not adsorbed to suspended particles.
The U.S. EPA requires a 14-day interval between treatment of water with diquat dibromide and use of treated waters for domestic, livestock, or irrigation purposes. Swimming, fishing and watering of domestic animals should not be allowed for at least 14 days after application of the herbicide to water. The herbicide cannot be used for any purpose in commercial fish processing areas.
Breakdown of Chemical in Vegetation: Diquat is rapidly absorbed by the leaves of plants. Usually, plant tissues are killed too quickly to allow translocation to other parts of the plant. The herbicide interferes with cell respiration, the process by which plants take in oxygen. The chemical structure of diquat is not changed or degraded within plants. Rather, after it is sprayed on plants or dead/decaying vegetation, diquat is broken down on the surface by photochemical degradation. The resulting intermediate residues of diquat are incorporated with the plant materials into the soil, where, through a process called 'microbial degradation, they are changed into carbon dioxide by soil microorganisms. Diquat dibromide is also rapidly absorbed by weeds in water, which causes the concentrations of the material in plant tissue to be higher than in surrounding water. Low concentrations of the herbicide in water are adequate for controlling aquatic weeds.
Since diquat dibromide is a nonselective herbicide with non-crop use patterns that overlap endangered plant habitats, it may present a danger to nontarget plants, including endangered species
Ecotoxicity:
Effects on Birds: Diquat dibromide ranges from moderately toxic to practically nontoxic to birds, depending on the species . Its acute oral LD50 in twelve young male mallards was 564 mg/kg. Signs of poisoning in these birds included instability, wing-drop and lack of movement. The oral LD50 for diquat was 200-400 mg/kg in hens
Effects on Aquatic Organisms: Diquat dibromide is slightly toxic to fish. Its toxicity to fish, and food organisms on which fish survive, has been reported in many studies. It appears to be less toxic in hard water. The lethal concentration fifty, or LC50 is that concentration of a chemical in air or water that kills half of the experimental subjects exposed to it for a specific time period. The 8-hour LC50 for diquat in rainbow trout is 12.3 ppm, and 28.5 ppm in Chinook salmon. The 96-hour LC50 in northern pike is 16 ppm and 20.4 ppm in fingerling trout . The shell growth of eastern oysters was not noticeably affected with exposure to 1 ppm of diquat for 96 hours.
Some species of fish may be harmed, but not actually killed, by sublethal levels of diquat dibromide. Oxygen can become depleted in diquat-treated water by decaying aquatic plants. This decreases the amount of oxygen available for fish survival. Research indicates that yellow perch suffer significant respiratory stress when herbicide concentrations in the water are similar to those normally present during aquatic vegetation control programs. Strip application of the herbicide over water is recommended to prevent large scale fish kills.
There is little or no bioconcentration of diquat dibromide in fish. Bioconcentration is the buildup or accumulation of a chemical in plants and/or animals. One investigation into the persistence of diquat in fish showed that one half of the herbicide was lost in less than three weeks.
The cationic pesticides, notably diquat and paraquat, are readily soluble and dissociate in aqueous solution. In water they biodegrade rapidly with half life figures of about 50 days. However they are strongly adsorbed to soil particles by cation exchange mechanisms. X-ray studies indicate that they bind between parallel silicate sheets of various clays with adsorption behaviour dependent on the surface charge density of the clay. As soil-bound residues they are resistant to microbial degradation and photo-decomposition and therefore persist indefinitely but in this form are biologically inactive. Rates of loss of adsorbed pesticide have typically been estimated as 10% per year which results in a field half-life of 6.6 years. They are nonvolatile and are not transported in the vapour phase. Environmental transport of these residues therefore tied to sediment transport processes.
Cationic substances, and their polymers and those polymers that are reasonably anticipated to become cationic in the natural aquatic environment (pH range 4-9) may be environmental hazards. Exempt from this concern are those polymers to be used only in solid phase, such as ion-exchange resins, and where the FGEW of cationic groups is not 5000 and above. Cationic groups such as alkylsulfoniums, alkylphosphoniums and quaternary ammonium polymers are highly toxic to fish and other aquatic organisms. Similarly potentially cationic groups such as amines and isocyanates are of concern. Some cationics, however, may fall into the category of PLCs (polymers of low concern) provided they possess low charge density, and/or are not water-soluble or are not self-dispersing polycarboxylates or poly- (aromatic or aliphatic) sulfonate polymer.
DO NOT discharge into sewer or waterways.

Persistence and degradability

Ingredient	Persistence: Water/Soil	Persistence: Air
paraquat dichloride	HIGH	HIGH
diquat dibromide	HIGH	HIGH

Bioaccumulative potential

Ingredient	Bioaccumulation
paraquat dichloride	LOW (BCF = 1.9)
diquat dibromide	LOW (BCF = 5.7)

Mobility in soil

Ingredient	Mobility
paraquat dichloride	LOW (Log KOC = 652.4)
diquat dibromide	LOW (Log KOC = 828.8)

SECTION 13 Disposal considerations

Waste treatment methods

Product / Packaging disposal	▸ Containers may still present a chemical hazard/ danger when empty. ▸ Return to supplier for reuse/ recycling if possible. Otherwise: ▸ If container can not be cleaned sufficiently well to ensure that residuals do not remain or if the container cannot be used to store the same product, then puncture containers, to prevent re-use, and bury at an authorised landfill. ▸ Where possible retain label warnings and SDS and observe all notices pertaining to the product.

Continued...

Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. In some areas, certain wastes must be tracked.
A Hierarchy of Controls seems to be common - the user should investigate:
- Reduction
- Reuse
- Recycling
- Disposal (if all else fails)

This material may be recycled if unused, or if it has not been contaminated so as to make it unsuitable for its intended use. If it has been contaminated, it may be possible to reclaim the product by filtration, distillation or some other means. Shelf life considerations should also be applied in making decisions of this type. Note that properties of a material may change in use, and recycling or reuse may not always be appropriate.
- **DO NOT** allow wash water from cleaning or process equipment to enter drains.
- It may be necessary to collect all wash water for treatment before disposal.
- In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first.
- Where in doubt contact the responsible authority.
- Recycle wherever possible.
- Consult manufacturer for recycling options or consult local or regional waste management authority for disposal if no suitable treatment or disposal facility can be identified.
- Dispose of by: burial in a land-fill specifically licensed to accept chemical and / or pharmaceutical wastes or incineration in a licensed apparatus (after admixture with suitable combustible material).
- Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.

SECTION 14 Transport information

Labels Required

Marine Pollutant

HAZCHEM 2X

Land transport (ADG)

14.1. **UN number or ID number**	3016
14.2. **UN proper shipping name**	BIPYRIDILIUM PESTICIDE, LIQUID, TOXIC (contains diquat dibromide and paraquat dichloride)
14.3. **Transport hazard class(es)**	Class: 6.1 Subsidiary Hazard: Not Applicable
14.4. **Packing group**	III
14.5. **Environmental hazard**	Environmentally hazardous
14.6. **Special precautions for user**	Special provisions: 61 223 274 Limited quantity: 5 L

Air transport (ICAO-IATA / DGR)

14.1. **UN number**	3016
14.2. **UN proper shipping name**	Bipyridilium pesticide, liquid, toxic * (contains diquat dibromide and paraquat dichloride)
14.3. **Transport hazard class(es)**	ICAO/IATA Class: 6.1 ICAO / IATA Subsidiary Hazard: Not Applicable ERG Code: 6L
14.4. **Packing group**	III
14.5. **Environmental hazard**	Environmentally hazardous
14.6. **Special precautions for user**	Special provisions: A3 A4 Cargo Only Packing Instructions: 663 Cargo Only Maximum Qty / Pack: 220 L Passenger and Cargo Packing Instructions: 655 Passenger and Cargo Maximum Qty / Pack: 60 L Passenger and Cargo Limited Quantity Packing Instructions: Y642 Passenger and Cargo Limited Maximum Qty / Pack: 2 L

Sea transport (IMDG-Code / GGVSee)

14.1. **UN number**	3016
14.2. **UN proper shipping name**	BIPYRIDILIUM PESTICIDE, LIQUID, TOXIC (contains diquat dibromide and paraquat dichloride)

Continued...

14.3. **Transport hazard class(es)**	IMDG Class	6.1
	IMDG Subsidiary Hazard	Not Applicable
14.4. **Packing group**	III	
14.5 **Environmental hazard**	Marine Pollutant	
14.6. **Special precautions for user**	EMS Number	F-A, S-A
	Special provisions	61 223 274
	Limited Quantities	5 L

14.7. Maritime transport in bulk according to IMO instruments

14.7.1. Transport in bulk according to Annex II of MARPOL and the IBC code

Not Applicable

14.7.2. Transport in bulk in accordance with MARPOL Annex V and the IMSBC Code

Product name	Group
paraquat dichloride	Not Applicable
diquat dibromide	Not Applicable

14.7.3. Transport in bulk in accordance with the IGC Code

Product name	Ship Type
paraquat dichloride	Not Applicable
diquat dibromide	Not Applicable

SECTION 15 Regulatory information

Safety, health and environmental regulations / legislation specific for the substance or mixture

paraquat dichloride is found on the following regulatory lists

Australia Chemicals with non-industrial uses removed from the Australian Inventory of Chemical Substances (old Inventory)
Australia Hazardous Chemical Information System (HCIS) - Hazardous Chemicals
Australia Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) - Schedule 5
Australia Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) - Schedule 6
Australia Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) - Schedule 7

diquat dibromide is found on the following regulatory lists

Australia Chemicals with non-industrial uses removed from the Australian Inventory of Chemical Substances (old Inventory)
Australia Hazardous Chemical Information System (HCIS) - Hazardous Chemicals
Australia Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) - Schedule 5
Australia Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) - Schedule 6
Australia Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) - Schedule 7

Additional Regulatory Information

Not Applicable

National Inventory Status

National Inventory	Status
Australia - AIIC / Australia Non-Industrial Use	Yes
Canada - DSL	No (paraquat dichloride)
Canada - NDSL	No (paraquat dichloride; diquat dibromide)
China - IECSC	Yes
Europe - EINEC / ELINCS / NLP	Yes
Japan - ENCS	Yes
Korea - KECI	Yes
New Zealand - NZIoC	Yes
Philippines - PICCS	Yes
USA - TSCA	No (paraquat dichloride; diquat dibromide)
Taiwan - TCSI	Yes
Mexico - INSQ	No (diquat dibromide)
Vietnam - NCI	Yes
Russia - FBEPH	No (paraquat dichloride)
UAE - Control List (Banned/Restricted Substances)	Yes
Legend:	***Yes = All CAS declared ingredients are on the inventory*** ***No = One or more of the CAS listed ingredients are not on the inventory. These ingredients may be exempt or will require registration.***

SECTION 16 Other information

Continued...

Revision Date	05/05/2026
Initial Date	05/05/2026

Other information

Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.

The SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios. Scale of use, frequency of use and current or available engineering controls must be considered.

Definitions and abbreviations

- PC—TWA: Permissible Concentration-Time Weighted Average
- PC—STEL: Permissible Concentration-Short Term Exposure Limit
- IARC: International Agency for Research on Cancer
- ACGIH: American Conference of Governmental Industrial Hygienists
- STEL: Short Term Exposure Limit
- TEEL: Temporary Emergency Exposure Limit。
- IDLH: Immediately Dangerous to Life or Health Concentrations
- ES: Exposure Standard
- OSF: Odour Safety Factor
- NOAEL: No Observed Adverse Effect Level
- LOAEL: Lowest Observed Adverse Effect Level
- TLV: Threshold Limit Value
- LOD: Limit Of Detection
- OTV: Odour Threshold Value
- BCF: BioConcentration Factors
- BEI: Biological Exposure Index
- DNEL: Derived No-Effect Level
- PNEC: Predicted no-effect concentration
- MARPOL: International Convention for the Prevention of Pollution from Ships
- IMSBC: International Maritime Solid Bulk Cargoes Code
- IGC: International Gas Carrier Code
- IBC: International Bulk Chemical Code

- AIIC: Australian Inventory of Industrial Chemicals
- DSL: Domestic Substances List
- NDSL: Non-Domestic Substances List
- IECSC: Inventory of Existing Chemical Substance in China
- EINECS: European INventory of Existing Commercial chemical Substances
- ELINCS: European List of Notified Chemical Substances
- NLP: No-Longer Polymers
- ENCS: Existing and New Chemical Substances Inventory
- KECI: Korea Existing Chemicals Inventory
- NZIoC: New Zealand Inventory of Chemicals
- PICCS: Philippine Inventory of Chemicals and Chemical Substances
- TSCA: Toxic Substances Control Act
- TCSI: Taiwan Chemical Substance Inventory
- INSQ: Inventario Nacional de Sustancias Químicas
- NCI: National Chemical Inventory
- FBEPH: Russian Register of Potentially Hazardous Chemical and Biological Substances

end of SDS