

CARBON CONCRETE ADDITIVE



EdenCrete[®]

**SAFETY
INFORMATION**

WHAT IS EDENCRETE®?

EdenCrete products are encapsulated carbon nanotube-enriched liquid additives that are added to the concrete mix to improve the strength, durability and ductility of concrete.

- **EdenCrete HC®** [High Concentration] is used to enhance the performance of existing mix designs,
- **EdenCrete PZ®** [Pozzolanic Mixes] is used to improve the performance of concrete mixes which have high pozzolans [i.e. fly ash, slag, silica fume].

EDENCRETE IS SAFE TO USE

EdenCrete products contain chemically encapsulated carbon nanotubes dispersed and suspended in a non-respirable liquid.

Using world-first, breakthrough technology, EdenCrete is produced by chemically binding carbon nanotubes (CNT's). This process renders the CNT's safe to use and makes them soluble in water. CNT's are normally not water soluble and are hazardous in the dry, respirable powder form. Adding EdenCrete into concrete results in the EdenCrete molecules bonding with larger particles in the hydrating cement therefore providing enhanced performance benefits to the concrete.

ABOUT CDM SMITH & PRINCIPAL TOXICOLOGIST JOHN FRANGOS

CDM Smith was appointed by Parchem to undertake an independent evaluation of the toxicology of EdenCrete products. John is a certified toxicologist with the American Board of Toxicology, a Fellow of the Australasian College of Toxicology and Risk Assessment, and, is a leading practitioner in toxicology consulting. He has extensive experience in translating the significance of chemical exposures to people and their environments due to chemical contaminants in water, air, soil, food, medicines, workplaces or consumer goods.

John regularly acts as an independent expert in response to environment and public health threats and has conducted a diverse set of health based and ecological risk assessments as can be demonstrated by the significant projects he has delivered to the Australian Defence Force, Council for Australian Health Ministers, and the National Environment Protection Council.

DULUXGROUP'S COMMITMENT TO SAFETY



Parchem Construction Supplies, part of DuluxGroup, is the licensed distributor of EdenCrete in Australia and New Zealand.



DuluxGroup is committed to the safety of the products it sells, and continually strives to identify and understand safety and sustainability impacts associated with business activities, including products, operations and people.

EdenCrete was developed in Australia and is manufactured by Eden Innovations LLC in US. Eden Innovations LLC is an Australian ASX listed company.

INDEPENDENT VERIFICATION

EdenCrete's safety has been verified by studies in the USⁱ and by independent Australian toxicologist, John Frangos [M App. Sc [Toxicology], DABT, FACTRA] at CDM Smith.

WET CONCRETE MIX

The EdenCrete Frangos CDM Smith 2020ⁱⁱ report determined that exposure to CNTs, and associated health risk to workers, is negligible when using EdenCrete liquid products added to the concrete mix according to directions. This is supported by the US EdenCrete safety studies.

CUTTING & GRINDING

It is safe to cut or grind hardened concrete that contains EdenCrete when wearing the required, normal, standard Work Safe Australia PPE [personal protective equipment].

As there is no Australian Standard [AS] or American Standard Test Method [ASTM] that measures the liberation of free CNTs from cutting or grinding hardened concrete, air monitoring was conducted during the cutting and grinding process to assess for free CNTs in the surrounding environmentⁱⁱⁱ. In all industrial hygiene monitoring test cases, the EdenCrete Frangos CDM Smith 2020 report found that the concentration of free carbon in the air was less than 1 µg/m³ for 8-hour TWA of exposure, well below the recommended exposure level required by Work Safe Australia.

SHOTCRETE

It is safe to use shotcrete that contains EdenCrete when wearing the required, normal, standard Work Safe Australia PPE.

An industrial hygiene evaluation was conducted to evaluate anticipated exposure to CNTs during shotcrete application and determine the need for engineering controls or PPE^{iv}. CNTs were not present in a respirable form during the spray application of EdenCrete HC mixed with shotcrete, therefore no additional PPE needs to be recommended beyond the standard Work Safe Australia requirements.

References

- i. Eden Innovations Safety Summary and reference document – EC safety summary
NIOSH 2013-145 - Occupational Exposure to Carbon Nanotubes and Nanofibers.pdf 4; 201203 Australian Govt- Safe Handling and Use of Carbon Nanotubes 188;
Kang et al., NanoImpact 2017 230; Bishop_Erdely_Life Cycle_ACSNano2017 240; Supp Material_Figures_Bishop_Erdely_Life Cycle_ACSNano2017 255; Supp Material_Tables_Bishop_Erdely_Life Cycle_ACSNano2017 263
- ii. EdenCrete Frangos CDM Smith 2020ii Report – AU Toxicology Report_1000187 EdenCrete evaluation Rev0.pdf
- iii. Galson Laboratories Test No. L364428, Jan 2016 6601 Kirkville Road Site : Dumont Login No. : L364428
East Syracuse, NY 13057 Project No: EC (315) 432-5227 Date Sampled: 23-DEC-15 Date Analyzed : 12-JAN-16 Date Received : 07-JAN-16 Report ID : 917479 www.galsonlabs.com
- iv. Hellman & Associates – Shotcrete Trials, May 28th 2019 - INDUSTRIAL HYGIENE EXPOSURE ASSESSMENT - Carbon Nanotubes and Silica During Shotcrete Application; 11913 W. I-70 Frontage Road North Wheat Ridge, CO 80033, 303.384.9828; HGA - Independent EHS services and OSHA compliance assessments - <https://www.ehscompliance.com/>

FREQUENTLY ASKED QUESTIONS

▼ What are carbon nanotubes?

A carbon nanotube, or CNT, is a hollow, straw-like tube of carbon atoms whose walls are a single atom thick. Multi-walled CNTs used in EdenCrete contain multiple CNTs within one another, like nesting dolls.

▼ EdenCrete products contain liquid carbon nanotubes (CNT), is EdenCrete safe to use?

Yes. Carbon nanotubes (CNT) have only been found to pose a potential health risk in the raw, dry powdered form, as they can be respirable. EdenCrete products are supplied as liquid products with encapsulated CNTs dispersed and suspended in the liquid, which makes them non-respirable and hence do not pose a health risk.

In addition, liquid EdenCrete products are added to concrete after the cement is wet out, therefore aerosols are not expected to be generated, and an inhalation health risk is not anticipated. This finding has been verified in an independent 2020 report by John Frangos, the Principal Toxicologist at CDM Smith.

▼ EdenCrete products contain multiwalled carbon nanotubes (MWCNT). Are they more dangerous than single walled carbon nanotubes (SWCNT)?

No. MWCNTs involve several tubes set in concentric layers in a cylindrical shape, whereas SWCNTs only involve one, singular tube. Some research studies have proven that MWCNTs are stronger than SWCNTs, but this does not affect their exposure health risk.

In addition, the CNT's in EdenCrete are encapsulated/bound in the liquid form that is added to the concrete, and EdenCrete products are added to concrete after the cement is wet out. Therefore, aerosols are not expected to be generated, and an inhalation health risk is not anticipated. This finding has been verified in an independent 2020 report by John Frangos, the Principal Toxicologist at CDM Smith.

▼ Are EdenCrete products hazardous chemicals?

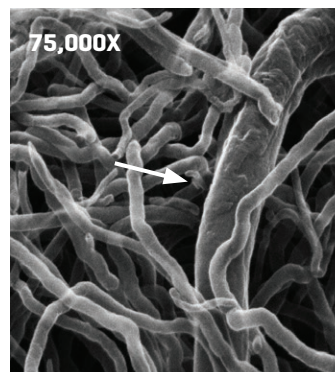
EdenCrete HC is classified as a non-hazardous material.

EdenCrete Pz is classified as a hazardous material due to another ingredient that is required for Pozzolanic Mixes and the appropriate PPE should be worn and directions followed as per any chemical that has a hazardous classification.

The EdenCrete SDSs are available on the Parchem website and contain this information and information about safe handling etc.

▼ Can CNTs become airborne from EdenCrete liquid additives?

No. CNT's in EdenCrete are chemically encapsulated and bound, and, EdenCrete products are supplied as liquids that are added to concrete after the cement is wet out, they then bind to larger particles in the concrete mix, so aerosols are not expected to be generated, and therefore no inhalation health risk is anticipated.



The arrow is pointing to a carbon nanotube that is bound to the hydrating cement.

Additionally, airborne concentration of elemental carbon of CNTs during product use is well below the NIOSH* recommendation of $1\mu\text{g}/\text{m}^3$ of elemental carbon for 8-hour TWA of exposure.

* National Institute for Occupational Safety and Health (NIOSH) 2013 'CURRENT INTELLIGENCE BULLETIN 65' DEPARTMENT OF HEALTH AND HUMAN SERVICES Centers for Disease Control and Prevention; Article can be found at: <http://www.particleandfibretoxicology.com/content/7/1/28>

▼ Can EdenCrete products ever change back to a hazardous form of CNTs?

No. EdenCrete products will remain chemically bound and will not revert to the original unincorporated nanotube state.

FREQUENTLY ASKED QUESTIONS

▼ Can dangerous levels of CNTs become airborne when cutting or honing hardened concrete containing EdenCrete and become a safety risk?

No. Concrete naturally has a higher level of silica than the level of elemental carbon that is present when it is used at the recommended dosage rate. CNT's in EdenCrete are chemically encapsulated and bound, and, EdenCrete products are supplied as liquids that are added to concrete after the cement is wet out, they then bind to larger particles in the concrete mix ensuring that they are not hazardous.

An airborne study concluded that when cutting hardened concrete, the air concentration of elemental carbon measured was well below the NIOSH recommendation of 1 µg/m³ of elemental carbon for 8-hour TWA of exposure. The study concluded that due to the non-detect CNT results, the small mixture percentage of EdenCrete HC in each batch of shotcrete, and the wet application methods used, it would be unlikely that CNTs are present in a respirable form during the application of EdenCrete HC mixed with shotcrete. This finding has been verified in an independent 2020 report by John Frangos, the Principal Toxicologist at CDM Smith.

NOTE: Standard Work Safe Australia PPE should always be worn when cutting concrete.

▼ Is EdenCrete safe to use in shotcrete?

Yes. EdenCrete products are supplied as liquids and are added to concrete in the plastic state, the EdenCrete products then bind to larger particles in the concrete mix. Therefore, when the concrete is sprayed, EdenCrete itself is not being aerosolized, hence it does not pose a health risk when used in shotcrete.

An airborne study conducted by Hellman & Associatesiv of shotcreting concrete with EdenCrete liquid additive measured the air concentration of elemental carbon for 8-hour TWA of exposure, to be below the NIOSH recommended exposure limit of 1 µg/m³.

▼ What PPE is required when using EdenCrete products?

Safety shoes, long sleeves, long pants, glasses and gloves are recommended when handling EdenCrete products – no special PPE is required.

When cutting, honing, sawing, abrasive blasting or performing any remedial work of concrete that generates dust, you must adhere to the standard, normal Work Safe Australia PPE recommendations.

▼ What should I do if the liquid EdenCrete gets on my skin?

If skin or hair contact occurs, remove contaminated clothing and flush skin and hair with running water. If swelling, redness, blistering or irritation occurs seek medical assistance.

The EdenCrete SDSs are available on the Parchem website and contain this information about skin contact.

▼ How do I handle a spill of the liquid EdenCrete?

Using the recommended PPE, a liquid spill should be dried before removal, or cleaned up with water and soap. The Environmental Protection Agency [EPA] requires EdenCrete product to be disposed into landfill or incinerated, it must not be allowed to enter waterways.

The EdenCrete SDSs are available on the Parchem website and contain this information about spills.

▼ If I spill Edencrete and it dries is it dangerous?

Even though EdenCrete will dry back to a powder, it will not revert to the original unincorporated nanotube state and is not hazardous.

▼ Can I aerosolize/atomise the liquid EdenCrete ?

No. As required by the EPA, EdenCrete products MUST NOT be aerosolized.

▼ How do I dispose of EdenCrete ?

EdenCrete must be disposed of according to EPA requirements including;

- EdenCrete in its liquid state must not be aerosolized,
- Liquid or dried additive can be disposed of via landfill or incineration, incineration is recommended,
- EdenCrete products must not enter waterways or be disposed of down drains,

The EdenCrete SDSs are available on the Parchem website and contain this information about disposal.



EDEN INNOVATIONS LLC WORKER SAFETY

As the manufacturer, Eden Innovations LLC ensures that it strictly adheres to approved, safe limits for its workers during the handling of powdered CNTs during the manufacturing process, and, closely monitors their workers to ensure the REL of $1 \mu\text{g}/\text{m}^3$ of elemental carbon in an 8 hour period is not exceeded. EdenCrete is supplied as liquids, and as such, users are not exposed to carbon nanotubes in the dry powdered form during addition to concrete mixtures.

AU 1300 737 787 parchem.com.au
NZ 0800 657 156 concreteplus.co.nz

Parchem Construction Supplies Pty Ltd 7 Lucca Road, Wyong NSW AUS 2259
Concrete Plus Ltd 150 Hutt Park Rd, Gracefield, Lower Hut, NZ 5010

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