

ESD – Definitions and Measurement

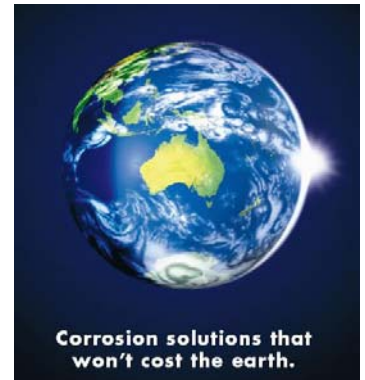
2.3.1

Current Situation

Increased building activity in coastal areas near Australian capital cities, where population is increasing at a greater rate than the national average, is placing pressure on our environment. **Construction material consumption** was **5,226 kg per person** per year in 2001, a staggeringly excessive figure, when you compare it with, say, paper consumption of 168 kg per person for the same period.^{i,ii}

Apart from the obvious land-fill problems associated with disposing of building material waste, there are other environmental costs to this building activity – high energy consumption, land degradation, water consumption and greenhouse gas emissions.

Australia has a high per capita level of **greenhouse gas emissions** by world standards. Greenhouse gas emissions increased by 16.9% between 1990 and 1998.ⁱⁱⁱ According to the Green Building Council of Australia, commercial buildings produce 8.8% of the national greenhouse emissions in this country, and therefore good design can play a major part in meeting Australia's international greenhouse obligations.^{iv}



What is ESD?

The Natural Step^v provides one of the broadest and most elegant definitions of **sustainable development**:

“Sustainable development is a dynamic process which enables all people to realise their potential and to **improve their quality of life** in ways which simultaneously **protect** and **enhance** our **Earth’s life support systems.**”



The official definition of **ESD** is **Ecologically Sustainable Development**, although environmentally sustainable design is also often used. ESD is development of property and infrastructure that attempts to **minimise impact on the environment**.

Ideally, environmental impact should approach zero, but in reality, as all human activity affects the environment to an extent, **Dulux Protective Coatings’ perspective** on **ESD** is about **measuring**, in some way, **the ecological impact** by each building activity, developing **best practice** for each of these to achieve the **lowest ecological impact**, and monitoring and revising these with a view to **continuously improving environmental outcomes**.

Australian ESD legislation and policies for Australian Government buildings^{vi} provides direction for:

- *Planning buildings with a view to the long term while being feasible in the short term*
- *Using the precautionary principle in all decision making*
- *Taking a global approach to issues*
- *Input from users and communities on building projects*
- *Avoiding the use of materials that have a negative effect on biodiversity*
- *Ensuring healthy indoor environments*
- *Reporting on performance*

How Can I Measure ESD?

There are a number of bodies that have been established to advise on ESD:

ESD – Definitions and Measurement

2.3.1

Australian Building Greenhouse Rating (AGBR)

The ABGR scheme allows office building owners and occupants to measure and reduce energy demands and hence greenhouse emissions. ABGR was developed and is managed by Australian Government and is endorsed by the Property Council of Australia.^{vii} The ABGR tool has been adopted by both the **Green Building Council** in its **Greenstar Environment Rating System** and the **National Australian Built Environment Rating System** (NABERS) for their energy component.



Green Building Council

The **Green Building Council** is a national, not-for-profit organisation bringing together industry and governments with the very practical mission to:

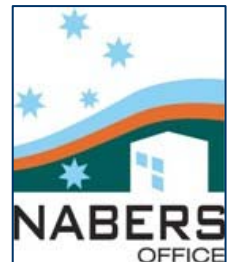
“...develop a **sustainable property industry** for Australia and drive the adoption of **green building practices** through **market-based solutions**.”^{viii}

The **Greenstar Environment Rating System**, developed by the **Green Building Council**, is a tool that enables the user to rate building practices, such as choice of building materials, with the intention of selecting those with lower environmental impact and lower embedded thermal demands.



National Australian Built Environment Rating System (NABERS)

NABERS is a method of measuring the environmental performance of existing buildings. It takes into account the building itself, as well as the **activities of its occupants**, which can have a **profound impact** on the total environmental rating of the building as a whole.^{ix}



Standards Australia AS/NZ2312

Another important design tool is **AS/NZS 2312:2002**, “**Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings**”. This Standard aims to provide guidance for specifiers on coating systems for the protection of steel work against corrosion. The specifier can select a coating system based on expected service life to first maintenance for various environments.^x This is also an important specification tool for ESD, as it offers a **performance comparison of corrosion protection systems** to allow the specifier to make an informed decision based not on immediate, short-term gains, but on ong-term benefits.



Current ESD Criterion to Rate Coatings

At the moment, most ESD ratings tools generally rate paint and coatings only in terms of their **VOC** content. It is hoped that **other important ecological effects** will be taken into account when rating coatings for ESD, such as **HAP** (hazardous air pollutant) **emissions**, **solid** and **liquid waste emissions**, **thermal energy demands** in manufacturing and application and distribution, and **durability** and **performance** of the finished material. All the above should be impartially compared with alternatives. All building materials should be assessed for **embedded energy** and **CO₂** emission; for example, whilst concrete emits only water whilst curing, cement production is estimated to produce about 5% of all CO₂ emissions from human sources worldwide.^{xi}

What is VOC?

VOC stands for Volatile Organic Component, or Compound. The term includes both naturally occurring and synthetic compounds. **VOC's** exist in a very broad range of products including but not limited to **food**, **household cleaning agents**, **glues**, **fabrics** and **linings**, **joint sealants**, **carpet backing**, **adhesives** for carpet, tiles, vinyl, laminate and joinery, **coatings** and **plastics**. In paint and coatings, **VOC** is also known as **solvent** or **thinner**.

ESD – Definitions and Measurement

2.3.1

The release of **VOC's** can affect the **coating applicator**, the **occupant**, and the **environment**. For more information, please refer to Dulux Protective Coatings Tech Note 2.3.2, ESD – Coatings and VOC.

Is VOC The Only Criterion Worth Considering?

VOC's are only a select group of gaseous emissions to the atmosphere – we really need to consider all hazardous air pollutants (HAPS), the worst of which are not organic compounds, but heavy metals such as mercury and lead, or inorganic acids. We also need to consider liquid and solid waste emissions to our already stressed environment. Energy consumption also needs to be taken into account, as do performance and longevity. So we urgently need a **holistic approach** – **all significant ecological impacts** need to be taken into account when designing buildings.

Total Ecological Impact Criteria Needed To Rate Coatings

We, as an organization, recognize that **sustainable design** is high priority. The functions of coatings are to **protect** and **beautify**, both of which are integral to sustainable design. To choose the right coatings to achieve the best environmental outcome for a project requires a rating system that takes into account all significant ecological impacts.

▪ *Total Emissions to the Environment and their Impact:*

- Obviously not all **VOC's** are equally harmful – many occur naturally^{xiii} (eg **monoterpenes** from pine trees, **isoprene** from deciduous trees, **citrus oil** from citrus, **eucalyptus oil** – the blue haze over the Blue Mountains, and **ethanol** from fermentation of fruit), some break down in the upper atmosphere to CO₂), whilst others are either biologically toxic and/or destroy the ozone layer. For example, chlorofluorocarbons (**CFCs**) break down the ozone layer that protects us from UV radiation (and are now banned). A ratings tool must be able to **distinguish** the bad from the neutral.
- Some processes consume and release significant quantities of **hydrochloric**, **nitric** or **sulphuric acids**, **chromates** and **heavy metal vapour** into the **atmosphere** – none of these **HAP's** (Hazardous Air Pollutants) are classified as **VOC's**, yet have **serious adverse effects** on the environment.
- **Total emission** of greenhouse contributors should be considered – **not just within buildings**, but also in spray shops and in the open, as all emissions end up in our upper atmosphere.
- Some processes produce large amounts of **solid waste**, including dust, which can become airborne and thus present inhalation hazards.
- Some processes produce large amounts of **hazardous aqueous waste**, such as contaminated corrosive acids, which present major disposal problems.

▪ *Long Term Performance:*

- The **overall performance** of a coating over the entire design life of the building, including maintenance requirements, is an **essential ESD indicator**. For example, if a two-pack solvent-borne protective coating can out-perform enamel paint with the same VOC level by decades, then it demonstrates a **clear advantage** in ESD. Conversely, if a waterborne paint fails to prevent deterioration of the substrate and requires frequent maintenance, then it demonstrates a poor choice with regard to ESD.
- Currently Green Star points are awarded for specifying **no coatings at all**, even if the **substrate may be subject to degradation** without a protective coating. Many common building materials **rapidly degrade** in coastal, industrial and CBD areas, creating needless and excessive rectification costs^{xiii}. The merit of using coatings that **significantly extend the life** of the building should be recognized^{xiv}. By their very nature, protective coatings add to the sustainability of the material. If we take steel as an example, the presence of a well-specified primer coating may add decades to the durability of the steel in a given environment.

ESD – Definitions and Measurement

2.3.1

- *Total embedded energy:*
 - The **total energy** required in raw material mining, processing, transportation, manufacturing, packaging and final application is another **essential ESD indicator**. It makes ecological sense to ensure that these essential raw materials are used in **high-performance coating formulations** that **maximise their longevity**. The longer a coating lasts, the less pressure placed on our **natural resources**.
 - Some processes, used as **alternatives** to zinc-rich coatings, have been favourably compared to zinc-rich coatings as they do not involve the use of **VOC's**, but mechanical handling during surface preparation, and **application of material** require **high thermal energy inputs** the form of electricity, gas or coal, to apply. Simply put, while they do not emit VOC's, they are responsible for emitting volumes of CO₂.
 - **Maintenance** of a building over its entire **life cycle** by the use of coatings not only requires the application of **additional coats**, but also **additional energy** in the erection of scaffolding and use of mechanical tools for removing degraded coatings and corroded substrates. Therefore, the specification and use of **high performance coatings** is vital in significantly reducing the frequency of maintenance and therefore lowering total energy input – **"do it once, do it right"**.

Green Specifications

When it comes to specifying coating systems for projects being designed within Green Star guidelines or you simply wish to minimise impact on the environment, call your Dulux Consultant. Many of our Consultants actively and regularly attend environmental conferences, seminars and training sessions, and can help you to specify the most **environmentally responsible** coating systems for your project.



For more information, please contact the Dulux Protective Coatings Technical Consultant in your state.

Dulux is a member of the Green Building Council of Australia.



ⁱ SoE 2006 Report (Australian Government)

ⁱⁱ SoE 2001 Report (Australian Government)

ⁱⁱⁱ SoE 2001 Report (Australian Government)

^{iv} Green Building Council Australia www.gbcaus.org

^v The Natural Step (TNS) founded in Sweden in 1989 by Dr. Karl-Henrik Robèrt. 64.207.158.76/au.naturalstep.org

^{vi} ESD Design Guide For Australian Government Buildings - Australian Government Department of The Environment and Heritage

^{vii} The Australian Building Greenhouse Rating scheme www.abgr.com.au

^{viii} The Green Building Council Australia www.gbcaus.org

^{ix} www.nabers.com.au

^x Australian/New Zealand Standard™ AS/NZS 2312:2002, Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings.

^{xi} Environmental Literacy Council Article, Cement: www.enviroliteracy.org/article.php/1257.html

^{xii} More than a change of color: Autumn foliage may affect air quality, climate.

www.ucar.edu/communications/staffnotes/0110/foilage.html

^{xiii} Srikanth Venkatesan, "Evaluation of distress mechanisms in bridges exposed to aggressive environments"

http://www.2006conference.crci.info/docs/CDProceedings/Proceedings/P101_Venkatesan_R.pdf

^{xiv} Dulux Protective Coatings Tech Note **2.3.3 ESD And Coating Specifications**.