Sustainable Earth®

Innovating with Green Chemistry

Formulating Professional Cleaning Products Using Green Chemistry and DfE Principles

Presented at the Green Chemistry III Symposium: Synthesis of Success
Sponsored by the California Department of Toxic Substances Control

Tuesday, October 30, 2007
Cal/EPA Byron Sher Auditorium
Sacramento, California

by
Roger McFadden
Chief Science Officer
Vice President of Science and Technology
Corporate Express

Corporate Express®
Productivity in your hands.

Sustainable Planning and Development

Sustainable Earth

“It is not what we have that will make us a great nation; it is the way in which we use it.”

– Theodore Roosevelt

Brief Overview of Commercial Buildings and Professional Cleaning Industry

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- Over 5 million commercial buildings need to be cleaned in the U.S.
- 50 billion sq. ft. of cleanable commercial floor space
- Commercial buildings consume 18% of all energy use in the U.S.
- By 2025, commercial building floor space is expected to reach 105 billion sq. ft. – a 46% increase over current levels.
- This floor space will need to be cleaned and maintained.

Impact of Hazardous Cleaning Products on Cleaning Professionals

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- It is estimated that 180,000 cleaning professionals are injured by the commercial cleaning products they use.
- Respiratory system irritation and burns to eyes and skin make up the majority of these on the job injuries
- Building occupants and visitors commonly complain about odors and respiratory problems associated with cleaning products and processes.
- Annually millions of dollars are spent for medical expenses and lost time wages due to these cleaning product chemical injuries.

Impact of Hazardous Cleaning Products on Building Occupants

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- Occupants commonly complain about unpleasant or annoying smells associated with cleaning products or cleaning activities.
- Some occupants have asthma and other breathing disorders and are sensitive to particles in the air, volatile organic compounds and vapors produced by the cleaning processes being used around them.
- Some occupants are highly sensitive to current types of solvents and organic vapors than can irritate eyes, nose and throat.
- Occupants complain about unsanitary conditions in public restrooms and food preparation or serving areas.
- Occupants get ill and miss work when they are exposed to pathogens and unhealthy conditions because of poorly maintained or areas that are not properly cleaned.

Impact of Cleaning on our *Planet Earth*

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- **Millions of pounds of nonyl phenol ethoxylates (NPEs) used in many cleaning products are annually discharged into our waste streams. NPEs are endocrine disrupters.**

- **Hundreds of thousands of pounds of phosphates formulated into cleaning products end up in our waterways and adversely effects aquatic life.**

- **Volatile organic compounds (VOCs) evaporate from cleaning products before, during and after their use, contributing to poor indoor air quality.**

Source: Northeast Waste Management Officials' Association (NEWMOA)

Our Green Chemistry Challenge

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To formulate a full line of high performance, cost competitive I&I cleaning products that are more sustainable, perform and have a reduced negative effect on environmental and human health when compared with competing cleaning products that serve the same purpose.

List of Cleaning Products to Be Formulated

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- General Purpose Cleaner
- Glass Cleaner
- Floor Finish and Sealer
- Wax and Finish Remover
- Carpet Cleaner
- Washroom Cleaner
- Odor Eliminator
- Graffiti Remover
- Carpet Spotter
- Toilet & Urinal Cleaner
- Liquid Hand Soap

Customers Pay For a Product Three Times

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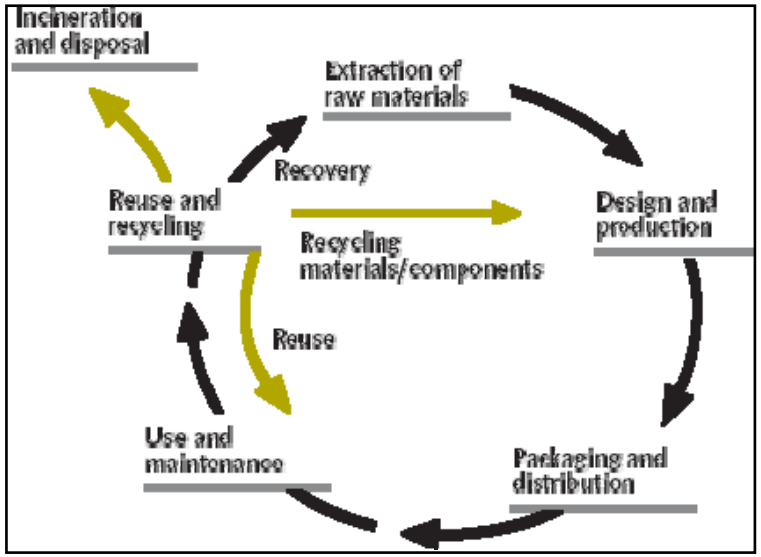
- Initial cost of the product
- Cost of handling and use of the product
- Cost of product disposal



What is a more sustainable cleaning product?

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- A more sustainable cleaning product is one that performs equal to or better than conventional or competing products and has a reduced effect on environmental and human health when compared with competing cleaning products that serve the same purpose.

Cornerstones of Sustainable Earth® Product Design?

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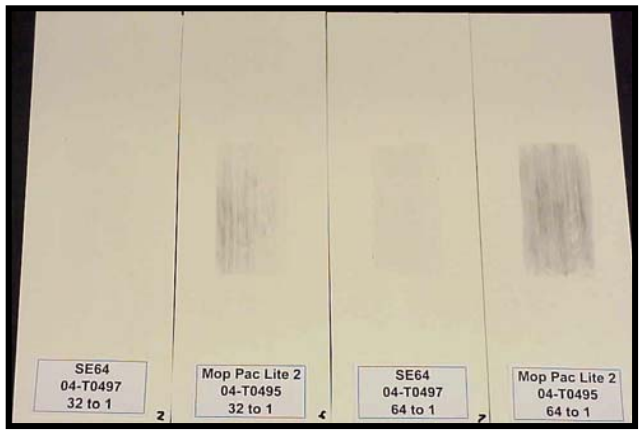
- **PERFORMANCE** – The product must perform as well or better than leading national brands of conventional products in same category.
- **PEOPLE** – The product must meet the highest international and domestic standards for health and safety.
- **PLANET** – The product must be based on sound science, independently tested and third-party certified to comply with the strictest environmental standards.
- **PRICE** – The product must be priced competitively with the leading national brands of conventional products in same category.



Our Sustainable Product Design Strategy

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- Define “sustainable cleaning product”
- Create a cleaning product design standard
- Identify a list of harmful chemicals
- Collect a list of safer alternatives
- Enter into a Partnership with the EPA DfE
- Formulate and conduct laboratory and field testing
- Submit formulations to independent, third-party organizations
- Finalize formulations and specifications

12 Principles of Green Chemistry*

1. Prevention of waste
2. Atom Economy
3. Less Hazardous Chemical Synthesis
4. Designing Safer Chemicals
5. Safer solvents and auxiliaries
6. Energy efficient
7. Renewable feedstocks
8. Reduce derivatives
9. Catalysis
10. Design for degradation
11. Real time analysis for pollution prevention
12. Safety

**Anastas, P.T. and J. Warner. 1999. Green Chemistry Theory and Practice*

How Sustainable Earth® Product Design Follows GC Principle #1:
Prevention of Waste

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- Rinse water used to wash down blending tanks is captured and used again.
- Defective HDPE containers found during QC processes are captured and recycled.
- Containers, shipping cartons and packaging materials are made from Post-Consumer Materials whenever possible and are readily recyclable.

How Sustainable Earth® Product Design Follows GC Principle #2:
Atom Economy

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- Specify purer raw materials.
- Titrate to arrive at precise acid and alkali neutralization points resulting in materials economy.
- Cloud points and CMC levels are carefully manipulated to get maximum efficiency from the mixtures.

How Sustainable Earth® Product Design Follows GC Principle #3:
Less Hazardous Chemical Synthesis

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- We use informed substitution as a pathway to less hazardous chemicals.
- Any synthesized chemical provided by our chemical suppliers is carefully scrutinized before it is selected for use in our SE products.
- All Sustainable Earth products that contain synthesized chemicals have at least one chemical that follows this principle.

Entered into a Partnership with the EPA Design for the Environment (DfE) Formulator Program

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- EPA DfE reduces our regulatory burdens by identifying problematic ingredients BEFORE we formulate
- EPA DfE allows companies to work with EPA chemists, environmental scientists, and staff to investigate materials that can further improve the health and environmental profiles of their products.
- Avoids expensive costs associated with product recalls or reformulations

How Sustainable Earth® Product Design Follows GC Principle #4-5: Designing Safer Chemicals and Safer Solvents and Auxiliaries

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- Formaldehyde was replaced with safer preservatives.
- Caustic chemicals were replaced with non-caustic materials.
- Flammable alcohols and glycol ethers were replaced with synergistic surfactant blends that are not flammable and provides improved performance
- Dibutyl phthalate was replaced with safer esters.
- Nonyl phenol ethoxylates are replaced with polyglucosides
- EDTA was replaced with Iminodisuccinate, An Environmentally Friendly and Readily Biodegradable Chelating Agent

* Won the Presidential Green Chemistry Award in 2001

Collected and categorized a list of chemicals found in conventional I&I cleaning products that are potentially harmful to human and/or environmental health.

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- **Carcinogens and Reproductive Toxins**
- **Neurotoxins**
- **Skin and Eye Irritants and Corrosives**
- **Skin Sensitizers**
- **Respiratory Irritants**
- **High Levels of Phosphates**
- **Volatile Organic Compounds**
- **Endocrine Disruptors**
- **Environmental Pollutants / Hazardous Waste**
- **Ozone-Depleting Chemicals**
- **Flammables and Combustibles**
- **Highly Reactive Chemicals**
- **Poorly Designed Packaging**

How Sustainable Earth® Product Design Follows GC Principle #6:

Energy Efficient

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- We designed all of the Sustainable Earth® to effectively perform in cold water.
- We designed our chemical dispensing systems to accurately mix product with water without electrical power.
- We formulated each product to be highly concentrated to reduce energy associated with transportation.
- Our gasoline powered delivery vehicles are being replaced with vehicles powered by biodiesel and/or hybrid vehicles
- We selected manufacturing plants and packaging points to be as close as possible to Corporate Express distribution centers.

How Sustainable Earth® Product Design Follows GC Principle #7:
Renewable Feedstocks

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- Vegetable derived surfactants and colorants
- Fruit derived acids and solvents
- Soybean oil extract
- Corn derived oils
- Orange peel and/or grapefruit seed extract
- Low levels of hydrogen peroxide
- Iminodisuccinate chelant
- Narrow range alcohol ethoxylate surfactants

How Sustainable Earth® Product Design Follows GC Principle #8-9:
Reduce Derivatives and Use Catalysis

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- Reduce number of raw materials
- Eliminate duplication and redundancy
- We use catalysts in several SE products to speed up a chemical reaction and improve chemical efficiency.

How Sustainable Earth® Product Design Follows GC Principle #10:
Design for Degradation

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- We use hydrogen peroxide in several of our SE products because it quickly degrades into simple water and oxygen.

- We replace nonyl phenol ethoxylates with polyglycoside surfactants because they degrade into benign substances unlike the NPEs that degrade into more toxic substances.

How Sustainable Earth® Product Design Follows GC Principle #11: Pollution Prevention

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- Select chemicals that are not considered hazardous waste.
- Use chemicals that benefit the waste stream rather than pollute it.
- Heavy metals are banned from use in SE products.

Pounds of Hazardous Chemicals Not Used Because of Green Chemistry Used to Design Sustainable Earth Products

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TIMELINE	ENDOCRINE DISRUPTERS	NEUROTOXINS	NPEs	SKIN SENSITIZERS	RESPIRATORY IRRITANTS	ASTHMAGENS	TOTALS
Before Green Chemistry	105,000	11,000	84,000	74,000	34,000	13,000	321,000
After Green Chemistry	0	0	0	0	0	0	0

*Pounds rounded to nearest thousand

How Sustainable Earth® Product Design Follows GC Principle #12: Safety

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- EPA DfE
- CleanGredients Database
- Green Gatekeeper™
- Compilation of all hazard information on a chemical to include detailed structure, p-chem properties, HHE toxicology and regulatory/administrative status.

Submit formulations to independent, third-party organizations for certification, validation and recognition.

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- EPA scientists review cleaning product formulations and recognizes companies and products with improved human and environmental attributes.
- Not for profit organization that certifies cleaning products based on consensus based third party certified environmental performance standards.
- Voluntary standard process designed to third party certify cleaning products against a rigorous set of safety, health and environmental criteria.
- Corporate Express internal cleaning product design standard and establishes benchmarks for continuous sustainable innovation and improvement.

Green Seal and EPA DfE Certification and Recognition Letters

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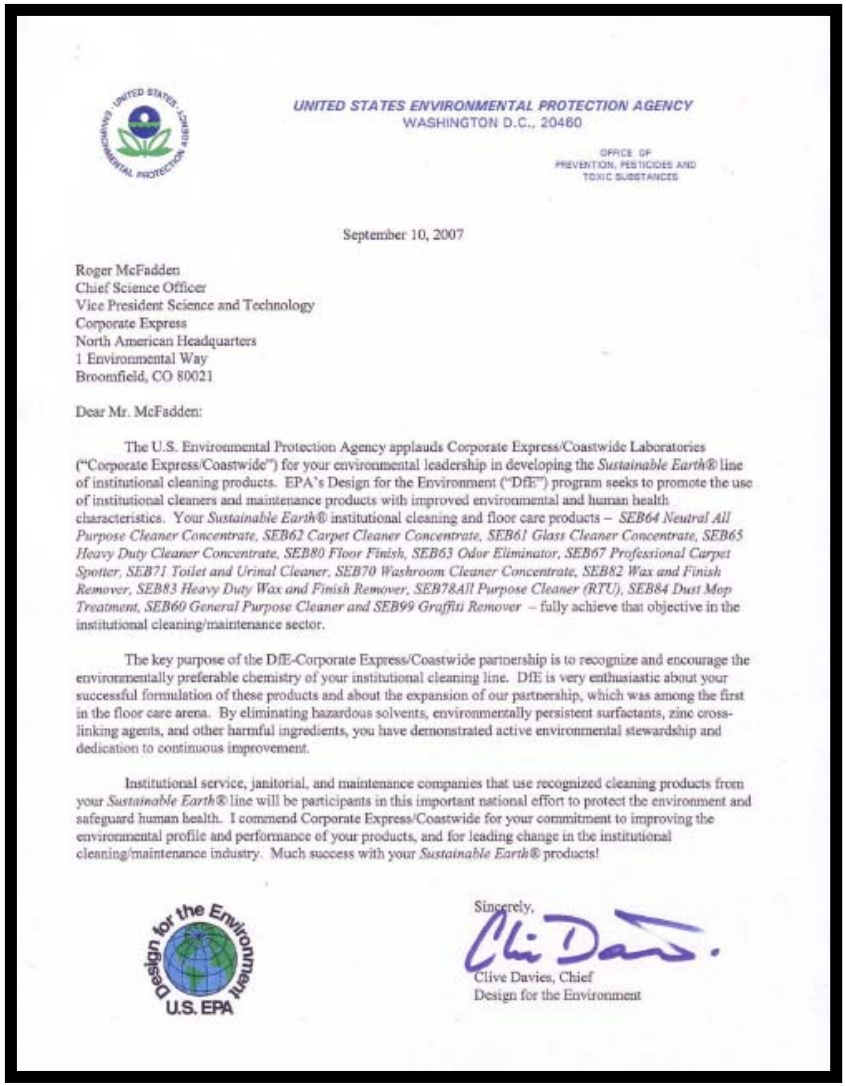


UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D.C., 20460

OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

September 10, 2007

Roger McFadden
Chief Science Officer
Vice President Science and Technology
Corporate Express
North American Headquarters
1 Environmental Way
Broomfield, CO 80021

Dear Mr. McFadden:

The U.S. Environmental Protection Agency applauds Corporate Express/Coastwide Laboratories ("Corporate Express/Coastwide") for your environmental leadership in developing the *Sustainable Earth®* line of institutional cleaning products. EPA's Design for the Environment ("DfE") program seeks to promote the use of institutional cleaners and maintenance products with improved environmental and human health characteristics. Your *Sustainable Earth®* institutional cleaning and floor care products – *SEB64 Neutral All Purpose Cleaner Concentrate, SEB62 Carpet Cleaner Concentrate, SEB61 Glass Cleaner Concentrate, SEB65 Heavy Duty Cleaner Concentrate, SEB80 Floor Finish, SEB63 Odor Eliminator, SEB67 Professional Carpet Spotter, SEB71 Toilet and Urinal Cleaner, SEB70 Washroom Cleaner Concentrate, SEB82 Wax and Finish Remover, SEB83 Heavy Duty Wax and Finish Remover, SEB78All Purpose Cleaner (RTU), SEB84 Dust Mop Treatment, SEB60 General Purpose Cleaner and SEB99 Graffiti Remover* – fully achieve that objective in the institutional cleaning/maintenance sector.

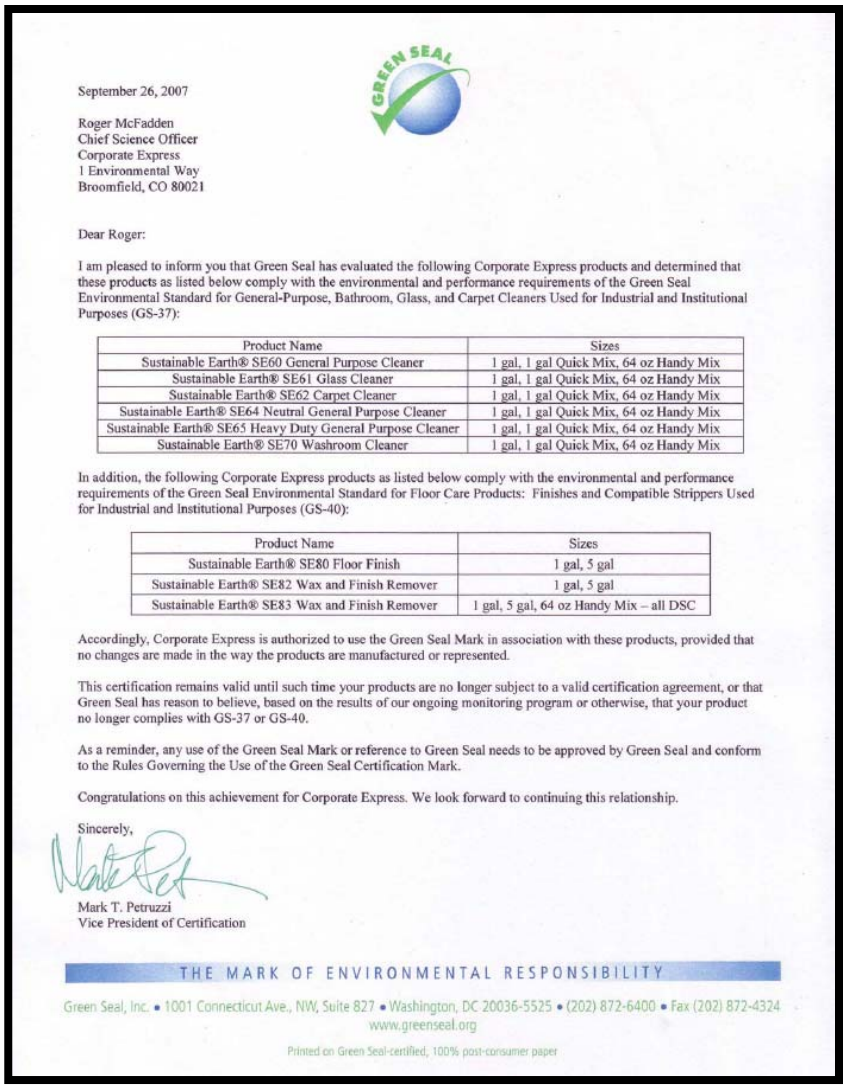
The key purpose of the DfE-Corporate Express/Coastwide partnership is to recognize and encourage the environmentally preferable chemistry of your institutional cleaning line. DfE is very enthusiastic about your successful formulation of these products and about the expansion of our partnership, which was among the first in the floor care arena. By eliminating hazardous solvents, environmentally persistent surfactants, zinc cross-linking agents, and other harmful ingredients, you have demonstrated active environmental stewardship and dedication to continuous improvement.

Institutional service, janitorial, and maintenance companies that use recognized cleaning products from your *Sustainable Earth®* line will be participants in this important national effort to protect the environment and safeguard human health. I commend Corporate Express/Coastwide for your commitment to improving the environmental profile and performance of your products, and for leading change in the institutional cleaning/maintenance industry. Much success with your *Sustainable Earth®* products!

Design for the Environment U.S. EPA

Sincerely,

Clive Davies, Chief
Design for the Environment



September 26, 2007

Roger McFadden
Chief Science Officer
Corporate Express
1 Environmental Way
Broomfield, CO 80021

Dear Roger:

I am pleased to inform you that Green Seal has evaluated the following Corporate Express products and determined that these products as listed below comply with the environmental and performance requirements of the Green Seal Environmental Standard for General-Purpose, Bathroom, Glass, and Carpet Cleaners Used for Industrial and Institutional Purposes (GS-37):

Product Name	Sizes
Sustainable Earth® SE60 General Purpose Cleaner	1 gal, 1 gal Quick Mix, 64 oz Handy Mix
Sustainable Earth® SE61 Glass Cleaner	1 gal, 1 gal Quick Mix, 64 oz Handy Mix
Sustainable Earth® SE62 Carpet Cleaner	1 gal, 1 gal Quick Mix, 64 oz Handy Mix
Sustainable Earth® SE64 Neutral General Purpose Cleaner	1 gal, 1 gal Quick Mix, 64 oz Handy Mix
Sustainable Earth® SE65 Heavy Duty General Purpose Cleaner	1 gal, 1 gal Quick Mix, 64 oz Handy Mix
Sustainable Earth® SE70 Washroom Cleaner	1 gal, 1 gal Quick Mix, 64 oz Handy Mix

In addition, the following Corporate Express products as listed below comply with the environmental and performance requirements of the Green Seal Environmental Standard for Floor Care Products: Finishes and Compatible Strippers Used for Industrial and Institutional Purposes (GS-40):

Product Name	Sizes
Sustainable Earth® SE80 Floor Finish	1 gal, 5 gal
Sustainable Earth® SE82 Wax and Finish Remover	1 gal, 5 gal
Sustainable Earth® SE83 Wax and Finish Remover	1 gal, 5 gal, 64 oz Handy Mix – all DSC

Accordingly, Corporate Express is authorized to use the Green Seal Mark in association with these products, provided that no changes are made in the way the products are manufactured or represented.

This certification remains valid until such time your products are no longer subject to a valid certification agreement, or that Green Seal has reason to believe, based on the results of our ongoing monitoring program or otherwise, that your product no longer complies with GS-37 or GS-40.

As a reminder, any use of the Green Seal Mark or reference to Green Seal needs to be approved by Green Seal and conform to the Rules Governing the Use of the Green Seal Certification Mark.

Congratulations on this achievement for Corporate Express. We look forward to continuing this relationship.

Sincerely,

Mark T. Petruzzi
Vice President of Certification

THE MARK OF ENVIRONMENTAL RESPONSIBILITY

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www.greenseal.org

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Case Study: Large Mass Transit Agency
700 buses and extensive light rail system

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- 70% decrease in cleaning chemical costs 4 SEB products replaced 22
- Skin, eye and respiratory irritation and odor complaints disappeared
- EHS department was pleased because they eliminated chlorine bleach from their bus washing stations
- They could transport the cleaning products from one facility to another without DOT Hazardous Materials labeling, costs and paperwork.
- Cleaning professionals reported that they “outperformed the conventional cleaning products that had been using for over ten years”

Thank YOU!

Sustainable Earth®

Corporate Express®

Productivity in your hands.