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## **ECOSURF™ EH Specialty Surfactants**

Fast Wetting, Low Odor, Biodegradable Surfactants  
with Low Aquatic Toxicity

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## ECOSURF™ EH Specialty Surfactants

ECOSURF™ EH specialty surfactants are a proven line of biodegradable, nonionic surfactants with low aquatic toxicity. They are designed to provide formulation flexibility, and to meet or exceed environmental requirements.

ECOSURF™ EH specialty surfactants meet US EPA Design for the Environment Surfactant Screen Criteria and are listed on CleanGredients®. They are approved for use as inert ingredients under 40 C.F.R. § 180.910, 920, 930, 940 (2014).

### An Excellent Choice for Your Formulating Needs

ECOSURF™ EH nonionic surfactants are formulated into a broad range of products capable of cleaning kitchen soil to industrial petroleum-based grease. ECOSURF™ surfactants are used for the following applications:

- **Agrochemicals** – inert ingredients for use in both tank mix and in-can formulations.
- **Concentrated and ultraconcentrated cleaning products**
- **Household cleaners** – hard-surface cleaners, bathroom cleaners, car wash and car care, laundry, prewash spotters, floor and carpet cleaners
- **Industrial and institutional cleaners** – janitorial cleaners, metal cleaners, electronic/precision cleaners, commercial car-wash cleaners, floor and carpet care, commercial laundry
- **Paints and coatings** – architectural, automotive, flexible and rigid packaging ink systems, industrial coatings and paints
- **Textile processing** – apparel, floor coverings, home furnishings, automotive, and industrial products





## Typical Physical & Performance Properties

### Dow Biodegradable Nonionic Surfactants

Product	Cloud Point <sup>1</sup>	HLB <sup>2</sup>	Moles EO	CMC <sup>3</sup> / Surface Tension <sup>4</sup>	Foam Height <sup>5</sup>	Pour Point <sup>6</sup>	Form <sup>7</sup>	APE Based <sup>8</sup>	Features	Applications
ECOSURF EH-3	Disp	7.9	PRT	480/30	0/0	-21	L	No	Excellent oil-soluble emulsifier, low foam, low odor, good handling, very low aquatic toxicity, listed on CleanGredients® and approved for DfE Formulations	Cleaners and degreasers, textiles, agrochemicals
ECOSURF EH-6	40	10.8	PRT	914/30	20/0	5	L	No	Exceptional wetting and hard surface cleaning, low odor, excellent handling and formulation properties, very low aquatic toxicity, listed on CleanGredients® and approved for DfE Formulations	Concentrates, cleaners & detergents, paints & coatings, textile processing, agrochemicals
ECOSURF EH-9	61	12.5	PRT	1066/31	60/0	16	L	No	Exceptional wetting and hard surface cleaning, low odor, excellent formulation properties, very low aquatic toxicity, listed on CleanGredients® and approved for DfE Formulations	Concentrates, cleaners & detergents, paints & coatings, textile processing, agrochemicals
ECOSURF EH-9 (90%)	61	12.5	PRT	1066/31	60/0	-5	L	No	Exceptional wetting and hard surface cleaning, low odor, improved handling and formulation properties, very low aquatic toxicity, listed on CleanGredients® and approved for DfE Formulations	Concentrates, cleaners & detergents, prewash spotters, paints & coatings, textile processing, agrochemicals
ECOSURF EH-14 (90%)	86	14	PRT	4018/32	70/10	6	L	No	Exceptional wetting and hard surface cleaning, low odor, improved handling and formulation properties, very low aquatic toxicity, listed on CleanGredients® and approved for DfE Formulations	Concentrates, cleaners & detergents, prewash spotters, paints & coatings, textile processing, agrochemicals

<sup>1</sup> Cloud point: °C, 10 wt% actives aqueous solution

<sup>2</sup> HLB range: < 10 w/o emulsifier, > 10 o/w emulsifier, 10-15 good wetting, 12-15 detergents

<sup>3</sup> Critical micelle concentration: ppm at 25°C

<sup>4</sup> Surface tension: dynes/cm at 1% actives, 25°C

<sup>5</sup> Ross-miles foam height: mm at 0.1wt% actives, 25°C, initial / 5 minute

<sup>6</sup> Pour point: °C

<sup>7</sup> Form at 25°C: L = Liquid, S = Solid

<sup>8</sup> APE = Alkylphenol ethoxylate

## Improved Environmental Profile

ECOSURF™ EH surfactants are readily biodegradable (> 60 percent biodegradation within 28 days per OECD 301F) and have an aquatic toxicity of EC<sub>50</sub> > 10 mg/L. These surfactants meet the criteria for the U.S. Environmental Protection Agency *Design for the Environment* (DfE) Surfactant Screen and are listed on CleanGredients®. Their rapid and complete biodegradation is expected in soil and surface waters, and during wastewater treatment.



Outstanding Properties for a Wide Range of Applications

The exceptional physical and chemical properties of ECOSURF™ EH surfactants effectively address the increasing demands of formulators today. The ECOSURF™ EH surfactant series performs well in the production of industrial and consumer products alike.

Low Pour Point and Narrow Gel Ranges

The low pour point and narrow gel ranges associated with ECOSURF™ EH surfactants, shown in Figure 1, minimize water in formulations.

Low Odor

Odor is a factor in many applications. ECOSURF™ EH surfactants have very low odor, making them an ideal choice for concentrated formulations, textile applications and other uses.

Wetting Performance Enables Exceptional Hard and Soft Surface Cleaning

ECOSURF™ EH surfactants provide excellent wetting. At concentrations above 0.05%, ECOSURF™ EH surfactants provide 20-second wetting times, per the Draves Wetting test method. Their wetting performance is comparable to many other types of surfactants, as shown in Figure 2.

Figure 1: Low Pour Point and Narrow Gel Ranges

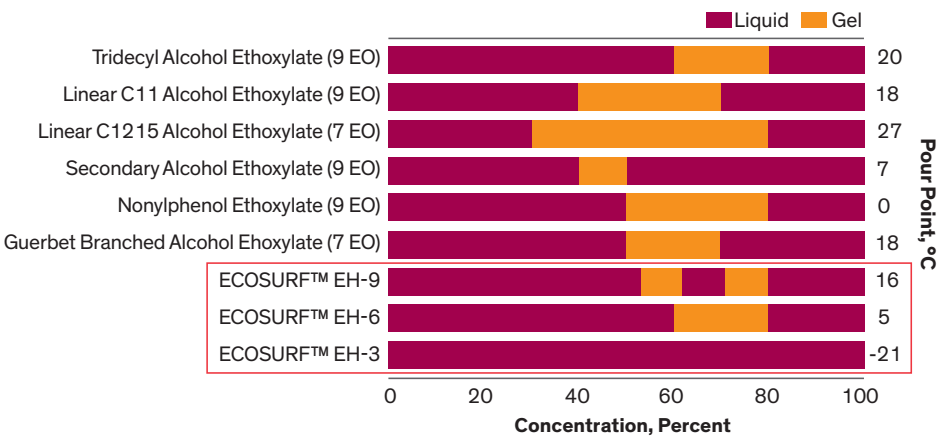
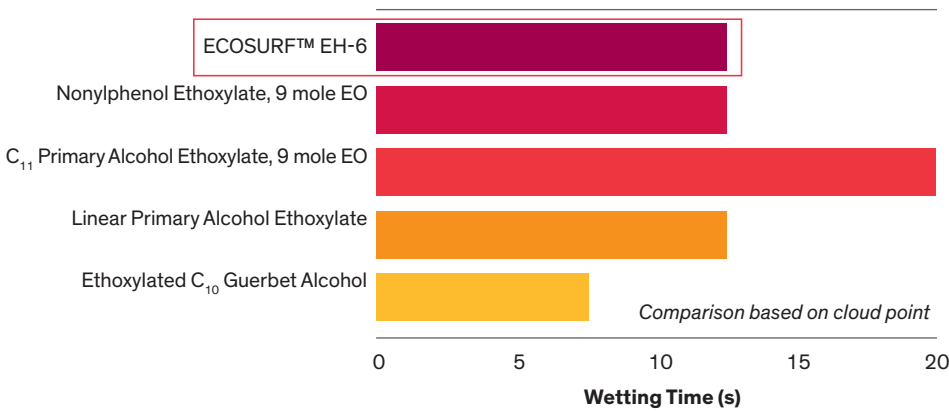
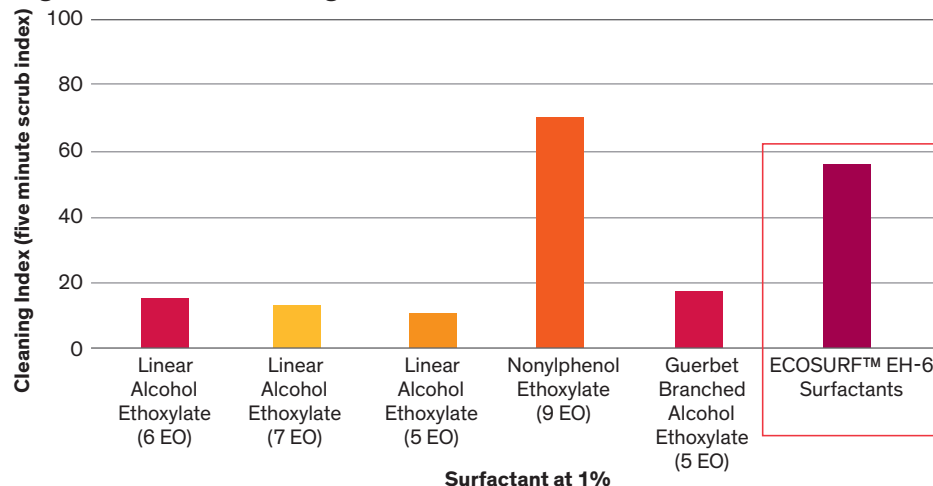


Figure 2: Draves Wetting Performance (0.1% Aqueous Surfactant at 25°C)

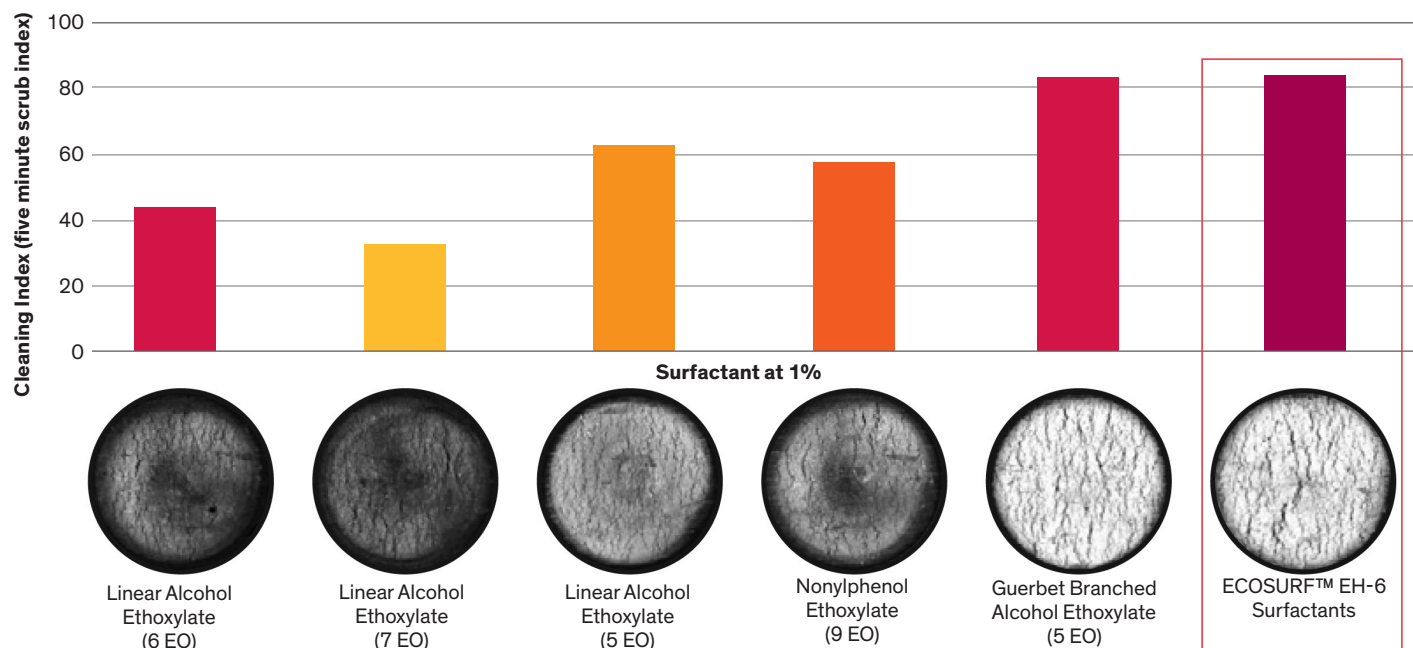


In hard surface cleaning applications, the performance of ECOSURF™ EH surfactants is similar to nonylphenol ethoxylates (NPEs). Figures 3 and 4 compare the relative cleaning efficiency of ECOSURF EH-6 to alternative products in cross-linked and non-cross-linked soils, respectively. In both cases, cleaning performance is outstanding and comparable to that of NPEs. Figure 4 shows the cleaning performance on non-cross-linked triglyceride soils applied to vinyl tile.

**Figure 3: Relative Cleaning Efficiencies on Cross-Linked Soils**



**Figure 4: Cleaning Performance on Non-Cross-Linked Triglyceride Soils**



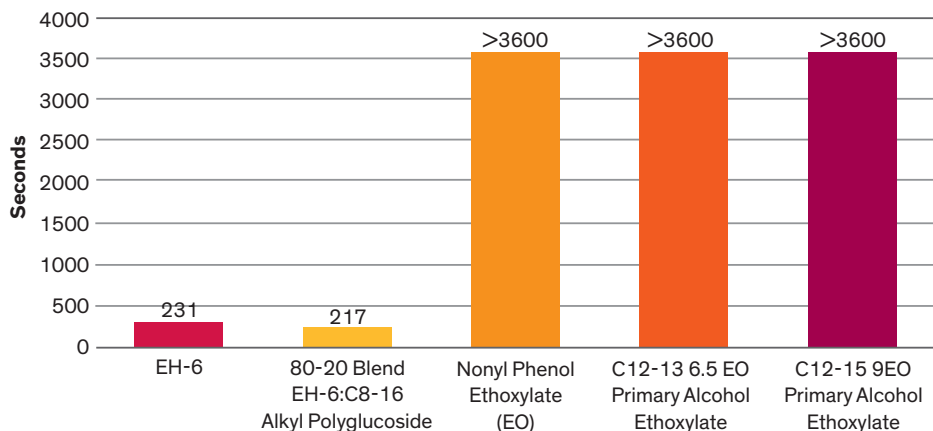
## Outstanding Properties for a Wide Range of Applications *(cont.)*

### Dissolution Time

Agricultural tank mix adjuvant formulations are applied under a wide variety of conditions. Spring applications often utilize cold water for dilution with limited mixing capabilities. Therefore, it is important for the adjuvant formulation to rapidly dissolve upon dilution in the spray tank. Figure 5 illustrates the dissolution time of a variety of nonionic alkoxyates. Rapid dissolution provides enhanced user convenience when applicators are operating in cold temperatures with limited agitation facilities.

**Figure 5: Dissolution Time\***

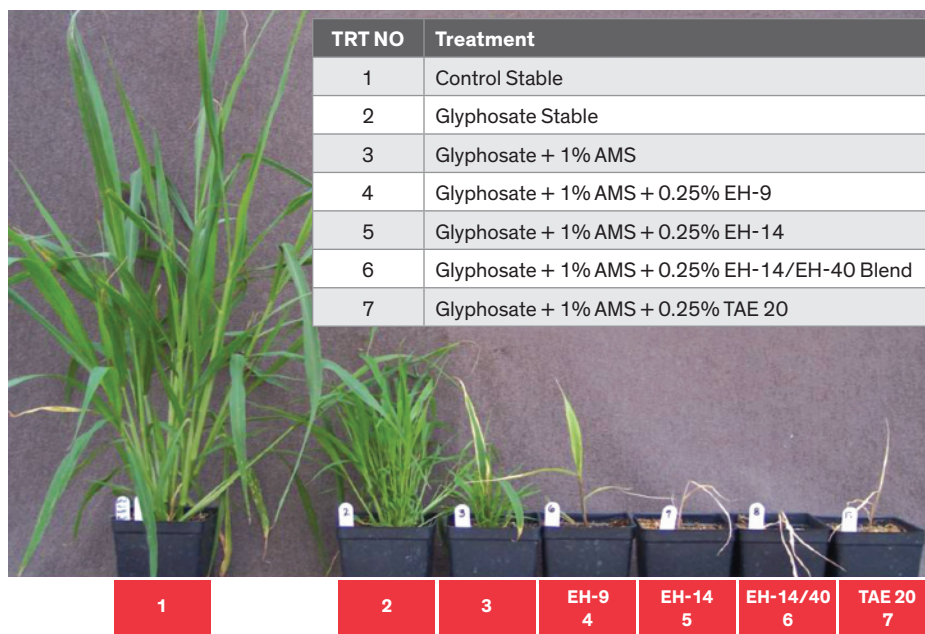
(Concentration of 10% by Weight to 40 °F Water with Constant Stirring)



### Bio-Efficacy

Adjuvants are broadly defined as substances which improve the performance of an active ingredient. In order to evaluate the adjuvant performance of ECOSURF™ EH Surfactants, they were applied with glyphosate IPA to giant foxtail in the presence of 1% ammonium sulfate (AMS). For comparison purposes tallow amine ethoxylate with 20 EO (TAE20) was also included in the study. When used with glyphosate, ECOSURF™ EH Surfactants improve the control of giant foxtail (Figure 6). The adjuvant effect improves as EO levels increase. The right balance of hydrophobe and hydrophile is crucial to achieve optimum results. The ECOSURF™ EH with the highest level of EO evaluated provided similar efficacy to TAE20.

**Figure 6: Adjuvancy on Giant Foxtail\***



### Phytotoxicity

The tolerance of ECOSURF™ EH-14 to corn and soybean was evaluated. No yellowing was observed after application. No crop injury was observed 14 days after treatment.

Glyphosate = Glyphosate IPA at 0.20 lb a.e. / A  
 AMS = Ammonium sulfate  
 EH# = 2-Ethyl-hexyl alkoxyate with # EO  
 TAE20 = Tallow amine ethoxylate 20 EO

\*Ng, S., Quencer, L., Clark, L., Karl, B., The Dow Chemical Company (2013). 2-Ethyl-Hexyl Alkoxyates as Adjuvants. *Farm Chemicals International*, November 2013, pp. 24-27



### Enhanced Formula Stability

ECOSURF™ EH surfactants are chemically stable in the presence of dilute acids, bases and salts. They may be used in formulations containing cationic antimicrobial agents and they are compatible with anionic, cationic and other nonionic surfactants, providing significant formulating flexibility – beyond NPE and PAE surfactants. Figure 7 shows stability performance of ECOSURF™ EH-9 surfactant compared to two comparable alkoxylates in three aqueous formulations. Figure 8 shows formula stability compared to NPE at 25°C.

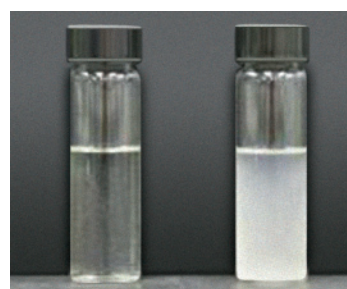
**Figure 7: 5% Surfactant; Aqueous Formulation**

Formula Composition	ECOSURF™ EH-9 Surfactant	NPE Surfactant	PAE Surfactant
15% LAS/2% Na Cit	Stable	Stable	Stable
15% LAS/4% Na Cit	Stable	Unstable	Stable
15% LAS/6% Na Cit	Stable	Unstable	Unstable

*Surfactant comparison based on cloud point*

LAS = Linear Alkyl Sulfonate    Na Cit = Sodium Citrate

**Figure 8: Formula Stability at 25°C**



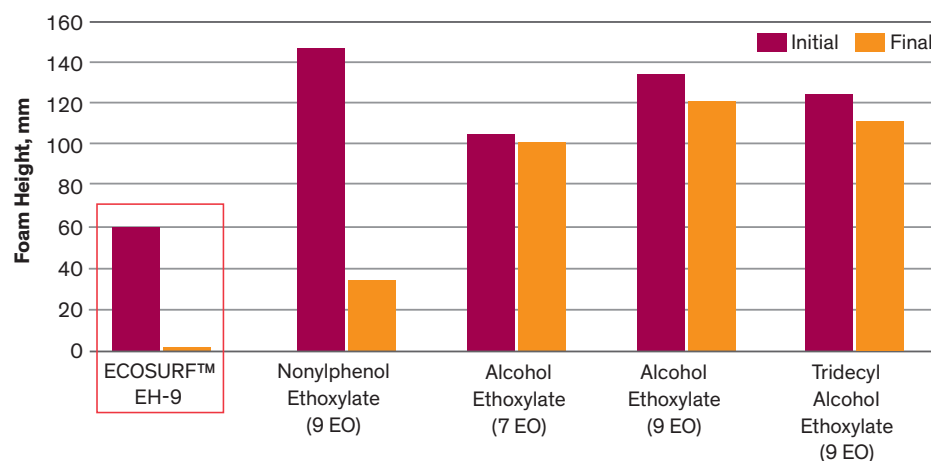
ECOSURF™ EH-9 (Stable)      NPE (Unstable)

### Low Foaming Profile

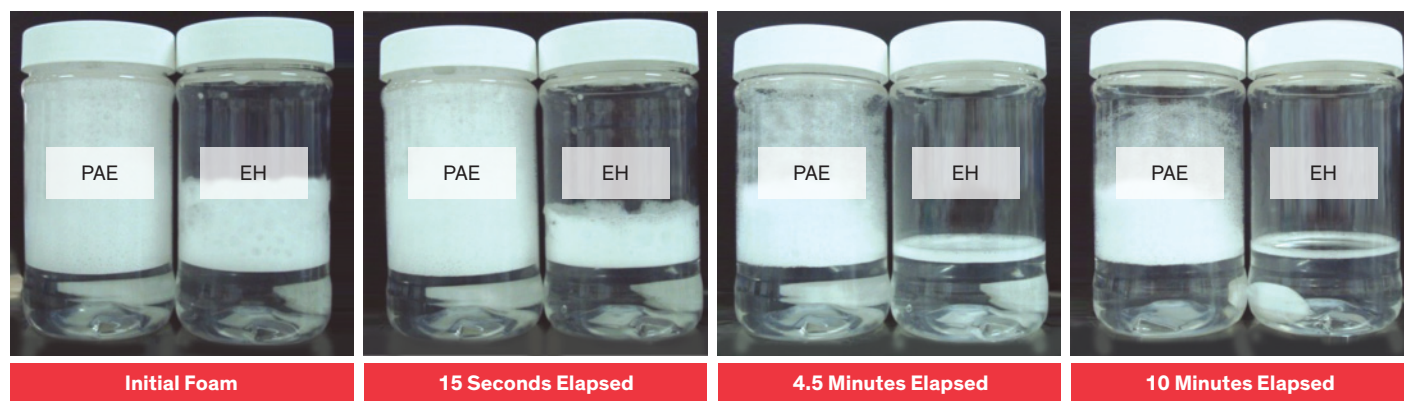
ECOSURF™ EH surfactants have minimal foam and provide very rapid foam collapse. Figure 9 shows ECOSURF™ EH-9 again out performs competitive products. Low foam can improve risibility and reduce or eliminate the need for foam control agents. ECOSURF™ EH surfactants are quick-rinsing, making them ideal for all-purpose cleaners and industrial applications including paints and coatings, metal cleaning and textiles.

**Figure 9: Rapid Foam Collapse**

(Ross Miles Foam – 0 min, 5 min)



### Foam Comparison with PAE





## Contact Us to Learn More

ECOSURF™ EH specialty surfactants offer outstanding properties and capabilities to meet your needs, including:

- Readily biodegradable
- Very low aquatic toxicity (DfE listed)
- Low foam, with rapid foam collapse
- Excellent wetting and hard surface cleaning performance
- Fast dynamic surface tension
- Enhanced formula stability
- Rapid dissolution
- Very narrow gel range
- Low odor, especially compared to PAEs

Please contact us for more information about how ECOSURF™ EH surfactants can improve your formulation experience and performance.

### Product Stewardship

Dow has a fundamental concern for all who make, distribute, and use its products, and for the environment in which we live. This concern is the basis for our product stewardship philosophy by which we assess the safety, health, and environmental information on our products and then take appropriate steps to protect employee and public health and our environment. The success of our product stewardship program rests with each and every individual involved with Dow products - from the initial concept and research, to manufacture, use, sale, disposal, and recycle of each product.

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