DOVER Chemical Corporation
A Subsidiary of ICC Industries Inc.

HIGH-PERFORMANCE ADDITIVES

Dover, Ohio facility

DOVER Chemical Corporation
A Subsidiary of ICC Industries Inc.

Dover Chemical Corporation is a leading producer of alkylphenols, chlorinated alkanes, polymer additives, liquid and solid antioxidants (including organophosphites), flame retardants, additives for water-based and oil-based metalworking fluids and drilling-fluid additives.

Our manufacturing facilities are located in Dover, OH and Hammond, IN. Our Dover location is along Interstate 77 in east central Ohio, providing easy access for shipping. The Hammond location is just 17 miles south of Chicago, along the Interstates 80-94 corridor.

Dover Chemical is proud to have earned ISO 9001:2008 certification in recognition of our ongoing commitment to uncompromising quality. We join other members and partners of the American Chemistry Council in our dedication to the principles of Responsible Care, including product stewardship, community awareness, emergency response, pollution prevention, process safety, distribution, and employee health & safety. Dover Chemical Corporation is a subsidiary of ICC Industries Inc., which is headquartered in New York.

Hammond, Indiana facility

ABOUT ICC INDUSTRIES INC.

The ICC Industries Inc. group of companies (www.iccindustries.com) develops, manufactures, trades and markets a diverse range of chemicals, plastics, pharmaceuticals, dietary supplements and related products. ICC is also an investor in a global leader in the field of flavors and ingredients for the food-and-beverage industries.

Headquartered in New York City since 1950, the ICC Group's origins trace back to Central Europe during the early 20th century, when Eugene Farber founded the United Factory for Varnishes and Paints in his home town of Timisoara, Romania. That company was nationalized after the Second World War, and in 1948 the Farber family left Romania. Eugene's son John made his way to the newly formed State of Israel, later immigrating to New York City to pursue his doctorate in the emerging field of polymer chemistry. There, he joined his father-in-law, Leslie Kleyman, at Mr. Kleyman's textile import-export business. Soon Dr. John Farber began sourcing chemical ingredients for the paints that his family had produced in Romania, selling them to European customers. That activity developed into ICC's chemical-trading business.

In the following decades, the ICC group expanded by adding companies that develop and manufacture a variety of products. One of them is the reprivatized paint and coatings company that the Farber family started in Romania, now known as SC Azur. ICC remains a family-owned company with Dr. Farber as its Chairman. Sandra Farber, representing the third generation of the family, serves as Vice Chair. We are proud of our history, and we look forward with enthusiasm to a future of sustainable growth and continued success of the ICC Group.

ALKYLPHENOL-FREE

DOVERPHOS® LGP-11®

When it comes to phosphites,
it's the natural choice

Introducing Doverphos® LGP-11®, an innovative, proprietary liquid-polymeric-phosphite stabilizer that is a suitable alternative to TNPP.

Doverphos® LGP-11® is unique in that it contains no alkylphenols. Additionally, it offers excellent compatibility in thermoplastic resins, resulting in reduced additive migration and exposure, especially for indirect food-contact applications.

FDA APPROVED

APPLICATION INFORMATION:

Doverphos® LGP-11® can be used in LLDPE, HDPE, PP and other polymers to protect against the effects of oxidative and thermal degradation to maintain MI and low color. Doverphos® LGP-11® is effective as a replacement for TNPP on a part-for-part basis.

PROPERTY	TYPICAL RESULT
Appearance	Clear to slightly hazy liquid
Refractive Index @ 25°C	1.4588
Specific Gravity @ 25°C	0.98
AV	0.01
Color, APHA	<50
Viscosity, CPS @ 25° C	~600

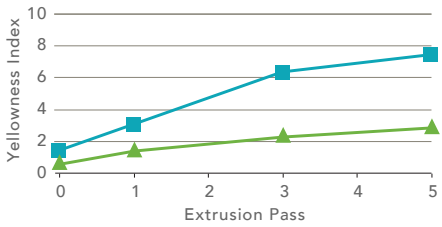
www.DoverChem.com/LGP-11

PERFORMANCE

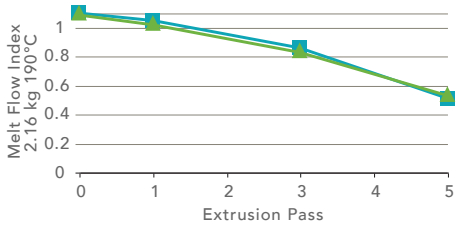
Process Stability

Process Stability in LLDPE (YI)

600ppm LGP-11 vs 600ppm TNPP

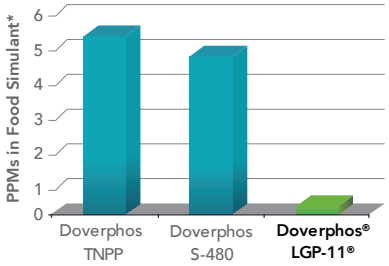


Process Stability in LLDPE (MFI)

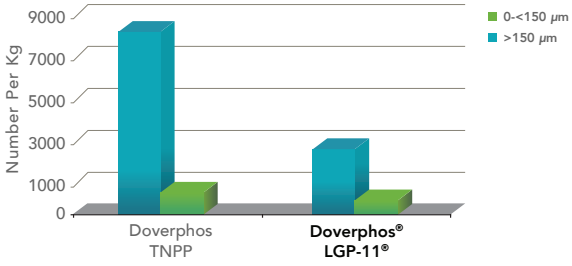


*Each formulation contains 600ppm primary AO

Low Migration

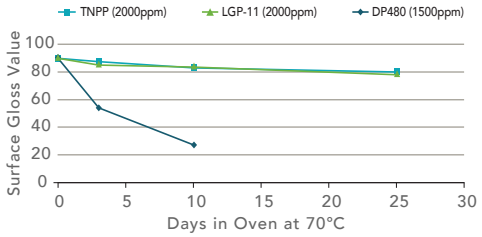


Excellent Gel Counts

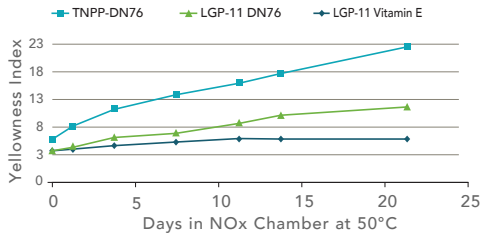


Excellent Compatibility / Gas Fade

Compatibility at 2000ppm in LLDPE



Gas Fade Resistance in LLDPE at 50° C



APPLICATIONS

- Plastic/cling wrap
- Deli wrap
- Snack food packaging
- Boil-in bags
- Lidded plastic food storage containers
- Resealable sandwich bags
- Diapers

ANTIOXIDANTS

for Heat Stabilization and Property Maintenance

Dover Chemical has grown into a leading producer of organophosphites by continuing to identify and meet market needs of product consistency, high purity, and fast-response time. Our ability to continually develop innovative products and our commitment to working closely with customers have contributed to our success with these products. Dover Chemical offers a line of solid antioxidants for use in a wide range of polymers to further broaden our product range.

DOVERPHOS SOLID ORGANOPHOSPHITES

Product	Appearance	Melting Point, °C	Phosphorus, %	Volatility, % @ 105°C/2 hr.	Assay, %	Refractive Index @ 60°C	Specific Gravity @ 60°C	Acid Number (mgKOH/gm)
Doverphos S-9228® Bis (2, 4-dicumylphenyl) pentaerythritol diphosphite	Off-white free-flowing powder	230	7.3	0.2	99.5	—	—	0.5
Doverphos S-9228T Bis (2, 4-dicumylphenyl) pentaerythritol diphosphite plus triisopropanolamine	Off-white free-flowing powder	230	7.3	0.2	99.5	—	—	0.5
Doverphos S-480 Tris (2, 4-di-tert-butylphenyl) phosphite	White free-flowing powder	185	4.8	0.1	99.5	—	—	0.1
Doverphos S-680 Distearyl pentaerythritol diphosphite	White flake	55	8.0	—	—	1.457	0.926	0.2
Doverphos S-682 Distearyl pentaerythritol diphosphite plus triisopropanolamine	White flake	56	8.0	—	—	1.457	0.926	0.2

DOVERNOX® SOLID ANTIOXIDANTS

Product	Appearance	Melting Point, °C	Molecular Weight	Solubility (gm/100 ml @ 20°C)				
				Acetone	Hexane	Methanol	Water	Ethyl Acetate
Dovernox 10 Tetrakis methylene (3,5-di-t-butyl-4-hydroxyhydrocinnamate) methane	White crystaline powder	115	1178	47.0	0.3	1.00<	0.01	46.0
Dovernox 76 Octadecyl 3,5-di-t-butyl-4-hydroxyhydrocinnamate	White free-flowing powder	51	531	19.0	32.0	0.6<	0.01	38.0

DOVERPHOS S-9228®

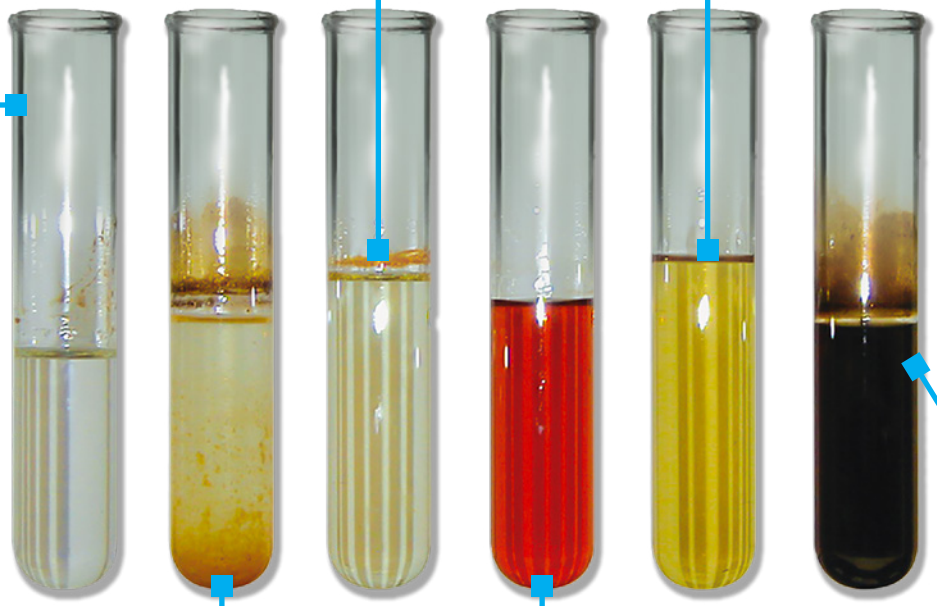
Clearly Superior High-Performance Phosphite

Doverphos S-9228® compared to various commercial phosphites after heating at 280°C for 120 minutes.

Doverphos HiPure® 4 Trisnonylphenyl Phosphite

Tris (2,4-di-t-butylphenyl) phosphite

Doverphos S-9228® Bis (2,4–di-cumylphenyl) pentaerythritol diphosphite. CAS registry No. 154862-43-8



Bis (2,4-di-t-butylphenyl) pentaerythritol diphosphite

Phosphorus trichloride, reaction products with 1,1'-biphenyl and 2,4-bis (1,1-dimethylethyl) phenol

Bis (2,6-di-t-butylphenyl-4-methyl pentaerythritol) diphosphite

Doverphos S-9228®'s high-molecular weight, low volatility, and high phosphorus content provide superior thermal stability that offers outstanding protection against discoloration and thermal degradation. Its unsurpassed hydrolytic stability prevents the formation of black specks.

Additional advantages of Doverphos S-9228® include:

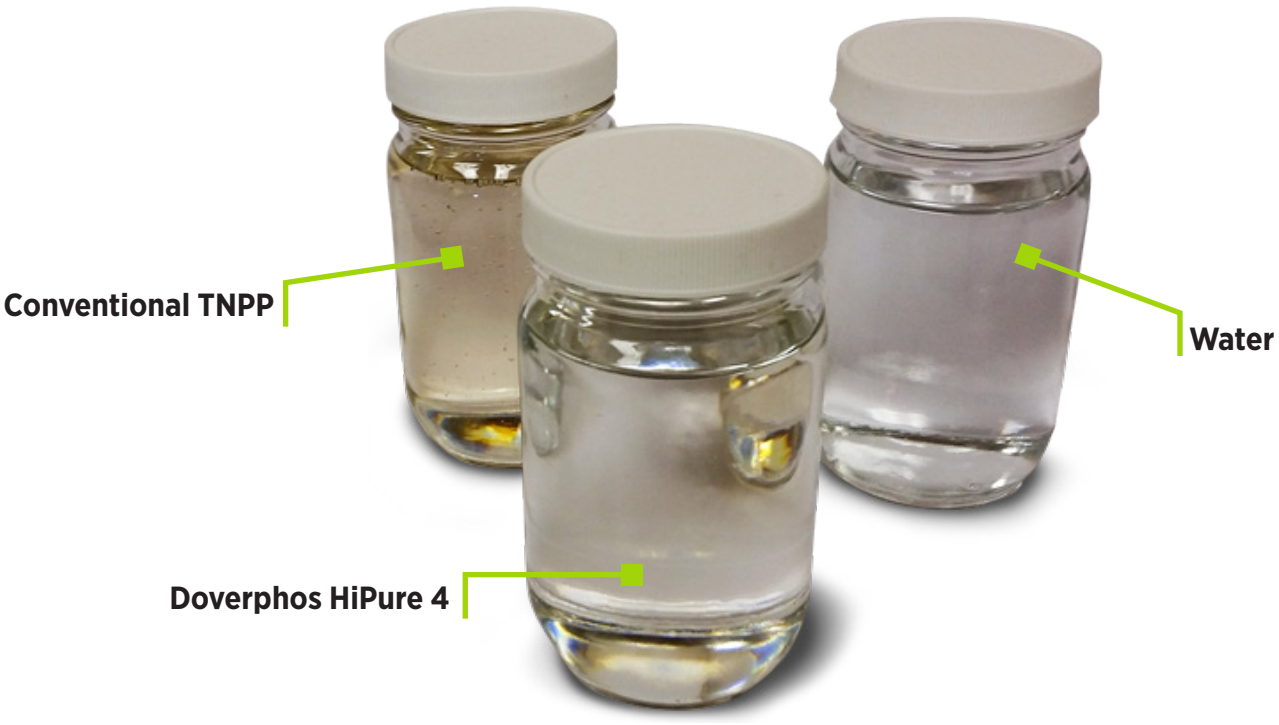
- Excellent for high temperature processing
- Low migration
- Low gel counts
- REACH compliant
- Global Regulatory sanction for use in food contact applications
- FDA sanctions for use in all polymers with no limitations on Conditions of Use and Food Types

DOVERPHOS LIQUID ORGANOPHOSPHITES

Dover Chemical is a leading global producer of organophosphites, designed to meet the antioxidant needs of a number of markets, including PVC and polyolefins.

Product	Color, APHA	Acid Number (mgKOH/gm)	Refractive Index @ 25°C	Specific Gravity @ 25°C/15.5°C	Appearance	% P	Density (lb/gal)	VISC cps @ 25°C
Doverphos 4 Trisnonylphenyl Phosphite	75 max.	0.1 max.	1.5255-1.5280	0.980-0.992	Clear Liquid	4.3	8.2	6000
Doverphos HiPure 4 Trisnonylphenyl Phosphite	75 max.	0.1 max.	1.5275-1.5295	0.980-0.997	Clear Liquid	4.5	8.2	7700
Doverphos 6 Triisodecyl Phosphite	50 max.	0.1 max.	1.4530-1.4610	0.884-0.904	Clear Liquid	6.2	7.4	15
Doverphos 7 Phenyl Diisodecyl Phosphite	50 max.	0.05 max.	1.4780-1.4810	0.938-0.947	Clear Liquid	7.1	7.8	17
Doverphos 8 Diphenyl Isodecyl Phosphite	50 max.	0.05 max.	1.5160-1.5190	1.022-1.032	Clear Liquid	8.3	8.6	14
Doverphos 9-EH Ethylhexyl Diphenyl Phosphite	50 max.	0.1 max.	1.5200-1.5240	1.040-1.047	Clear Liquid	9.0	8.7	9.5
Doverphos 10 Triphenyl Phosphite	50 max.	0.5 max.	1.5880-1.5900	1.180-1.186	Clear Liquid	10.0	9.8	17
Doverphos 11 Tetraphenyl Dipropyleneglycol Diphosphite	50 max.	0.2 max.	1.5770-1.5620	1.164-1.188	Clear Liquid	10.9	9.8	80
Doverphos 12 Poly (dipropyleneglycol) Phenyl Phosphite	50 max.	0.1 max.	1.5340-1.5380	1.168-1.180	Clear Liquid	12.0	9.8	487
Doverphos 49 Tris (tridecyl) Phosphite	50 max.	0.1 max.	1.4600-1.4650	0.882-0.900	Clear Liquid	4.9	7.4	41
Doverphos 53 Tris Alkyl (C12-C15) Phosphite	50 max.	0.1 max.	1.4545-1.4595	0.872-0.882	Clear Liquid	5.3	7.3	20
Doverphos 213 Diphenyl Phosphite	250 max.	15 max.	1.5540-1.5600	1.210-1.230	Clear Liquid	13.3	10.1	12
Doverphos 253 Dioleyl Hydrogen Phosphite	<3 Gardner	15 max.	1.4640-1.4700	0.880-0.910	Clear Liquid	5.3	7.5	35
Doverphos 613 Alkyl (C12-C15) Bisphenol A Phosphite	100 max.	0.1 max.	1.4910-1.4970	0.940-0.985	Clear to Slight Pink Liquid	5.4	8.0	230
Doverphos 675 Alkyl (C10) Bisphenol A Phosphite	100 max.	0.5 max.	1.4940-1.5090	0.910-0.980	Clear Liquid	6.7	7.9	275

DOVERPHOS HiPure 4 TNPP



BETTER HYDROLYTIC STABILITY THAN OTHER TNPP PRODUCTS

Hydrolysis conditions: 35°C and 85% relative humidity

TNPP is often used in a water emulsion for stabilizing polymers. It is critical that TNPP used in this application has good hydrolytic stability, since hydrolyzed TNPP is not an effective stabilizer and can also cause black specks.

Doverphos 4, the competitor TNPP, and Doverphos HiPure 4 sampled in this test do not contain TiPA. After 24 hours, Doverphos HiPure 4 released 58% less nonylphenol than the competing TNPP, and 29% less than Doverphos 4.

	Doverphos 4	Competitor TNPP	Doverphos HiPure 4
Time	**% Free Nonylphenol**		
Initial	2.5	1.6	0.06
4 hours	6.2	3.4	0.15
7 hours	7.0	8.0	0.18
12 hours	12.9	19.0	0.98
24 hours	19.8	34.0	14.10

	Doverphos 4HR	Doverphos HiPure 4HR
Time	**% Free Nonylphenol**	
Initial	4.0	0.03
4 hours	4.3	0.04
7 hours	4.6	0.04
12 hours	5.4	0.04
24 hours	5.5	0.04
48 hours	—	0.06
4 days	—	0.07
8 days	—	0.09
83 days	—	0.12

Doverphos 4HR and Doverphos HiPure 4HR contain TiPA to extend the hydrolytic stability of these products.

GET MORE ACTIVE PHOSPHITE

And less free nonylphenol with Doverphos HiPure 4 TNPP

Doverphos HiPure 4, HiPure 4HR and HiPure 4HR Plus offer the highest purity TNPP with the lowest level of free nonylphenol of any commercially available product.

Doverphos HiPure 4HR and Doverphos HiPure 4HR Plus provide enhanced hydrolytic stability to give better final color in end-use products. All Doverphos HiPure 4 grades are produced in totally automated ISO 9001 certified processes.

FOOD CONTACT PACKAGING

Doverphos HiPure 4 is Kosher-approved and sanctioned under FDA regulations for food-contact packaging applications in a number of polymer and rubber systems.

HEAT STABILIZATION

Doverphos HiPure 4 is an effective liquid phosphite heat stabilzer for a wide variety of polymer and rubber systems, including:

- Polyolefins
- Elastomers
- Adhesives
- Coatings
- Acrylics
- ABS
- PVC
- Nylon
- Polycarbonates
- Polyethylene Terephthalate
- Polyurethanes
- Polystyrenes

Typical use levels range from 0.05% - 3.0% for most applications.

NOMENCLATURE $(C_9H_{19}\text{-}C_6H_4\text{-}O\text{-})_3P$

CAS name	Trisnonylphenyl Phosphite
Molecular Weight	688
CAS Number	26523-78-4
U.S. Patent No.	5,532,401

PHYSICAL PROPERTIES

Appearance	Clear liquid
% Phosphorous	4.3
Density, lb./gal	8.2
Viscosity	7800cps @ 25°C

SPECIFICATIONS

Free Nonylphenol	0.1% maximum
Color, APHA	75 maximum
Acid No., mg KOH/gm	0.1 maximum (HiPure 4)
Refractive Index, 25°C	1.5275 - 1.5295
Specific Gravity	0.980 - 0.997

Doverphos HiPure 4
Gives better final color in end-use products and less free nonylphenol release during processing.

Doverphos HiPure 4HR
Contains 0.75% maximum triisopropanolamine for improved hydrolytic stability.

Doverphos HiPure 4HR Plus
Contains 1.0% triisopropanolamine for maximum hydrolytic stability.

STORAGE AND HANDLING

Phosphites tend to hydrolyze when exposed to moisture such as humid air. The extent of the hydrolysis will depend on the type of phosphite, temperature, degree of humidity and length of exposure.

Liquid phosphites, such as Doverphos HiPure 4, are more hydrolysis resistant than solid phosphites, due to a lower surface area exposed to moisture. The degree of hydrolysis can be determined by running an acid value on the phosphite. If the acid value is above the specification, some hydrolysis has occurred. A small degree of hydrolysis should not greatly affect the performance of the phosphite.

Doverphos HiPure 4HR and Doverphos HiPure 4HR Plus can be hazy at room temperature. This will not affect performance.

If the practices below are followed, unopened drums of liquid phosphites will have a shelf life of at least one year.

- Store bulk containers of phosphites under a dry atmosphere of nitrogen. Use either stainless steel tanks glass-lined tanks or carbon steel tanks coated with a phenolic lining such as Plasite® 3066 from Wisconsin Protective Coating Corporation.
- Handle phosphites in a dry nitrogen atmosphere.
- Use the entire drum of phosphite at one time. If the drum needs to be re-sealed, purge the vacant volume with dry nitrogen and re-seal the drum tightly.
- Store unopened drums inside to minimize temperature fluctuations that can cause the drum to breathe.

ALKYLPHENOLS

Building Blocks for High Performance Chemicals

In 1997, Dover Chemical built a state-of-the-art manufacturing facility to produce alkylphenol products. After several expansions and updates, today's facility is totally automated, assuring our customers of consistent quality para- and di-nonylphenol and para- and di-cumylphenol.

This plant represents a major investment for Dover Chemical's strategy to become a global supplier to the polymer industry. Alkylphenols typically are not used by themselves as additives, but are intermediates to produce high performance products. Markets for these products include surfactants, lube-oil additives, stabilizers for rubbers and plastics, dispersants, adhesives, and plasticizers for resins.

ALKYLPHENOL APPLICATIONS

SURFACTANTS: The largest industrial use for alkylphenol is in the manufacturing of nonionic surfactants. These ethoxylated alkylphenol surfactants have good chemical stability and excellent wetting, emulsifying and detergent properties.

TNPP: Nonylphenol is reacted with phosphorus trichloride to produce trisnonylphenyl phosphite (TNPP), a common antioxidant for a wide range of polymer systems.

PHENOLIC RESINS: Nonylphenol reacts with aldehydes to yield phenolic resins. When used with other phenols, even in small quantities, it makes the phenolic resins more water resistant, more soluble in oil, and improves electrical properties.

RUBBER CHEMISTRY: Nonylphenol sulfide has been used as a reclaiming agent for synthetic rubber.

PVC: Nonylphenol and nonylphenol derivatives can be used in PVC stabilizers.

EPOXY RESINS: Nonylphenol can be used in an epoxy resin hardener.

MISCELLANEOUS: Other applications for alkylphenols include pharmaceuticals, corrosion inhibitors, dyestuffs, ore flotation agents, insecticides, bactericides, chemical stabilizers, and the leather industry. Overbased calcium salt nonylphenol also can be used as a dispersant in hydraulic fluid and motor oil.

ALKYLPHENOL TYPICAL PROPERTIES

	Color, APHA	NP %	Ortho NP %	Para NP %	DNP %	Water, ppm
Para-nonylphenol	20	98	5	93	2	150
Para-nonylphenol TG	30	96	5	91	3.8	160
	Color, Gardner		**Specific Gravity**		**DNP %**	
Di-nonylphenol 90%	6		0.900 – 0.940		90.3	
	Color, APHA		**PCP %**	**Molecular Weight**	**Melting Point**	
Para-cumylphenol	20		99.8	212	70° C	
	Color, Gardner		**2,4 DCP %**	**Molecular Weight**	**Melting Point**	
Di-cumylphenol	1		97.0	330	~60°	

LUBRICANTS

for Straight Oils, Soluble Oils and Synthetic Coolants

Dover Chemical offers one of the widest arrays of metalworking additives available anywhere to the compounder/blender. Our core product line of extreme pressure (EP) additives answers the technology requirement needed in modern machining techniques. We are the leader in S, Cl, and P additives, as well as offering various alternatives to chlorinated chemistries. Additionally, our boundary lubricant additives, oil-soluble as well as water-soluble, further supplement and enhance our EP additives role and function in the various chip-making and metal-deformation operations. The majority of our additives are single components, providing our customer with the flexibility to design their own products. However, Dover Chemical also offers packages and concentrates for those customers who do not wish to stock small quantities of multiple additives to produce their own emulsifier packages or lubricity agents. Finally, supporting our chemistries, and customers, is our laboratory, our direct sales force, and our global-distribution network.

SULFURIZED ADDITIVES

Product	Vis @ 100°F, SUS	Vis @ 40°C, cS	Vis @ 210°F, SUS	Vis @ 100°C, cS	% Sulfur	% Active	Neut #	Flash Point, °F	Description
Lard Oils and Esters – Non-Staining to Copper									
Base 10SE	102	21	42.5	9	10	0	8	400	Sulfurized methyl ester
Base 101	1100	230	125	25	10	0	6	350	Sulfurized lard oil
Maysperm 2011LV	1750	370	200	40	10.5	0	9	400	Sulfurized lard/ester
Mayco Base 1351	1775	375	175	35	10.5	0	7	400	Sulfurized lard/olefin
Maysperm 2011	3500	750	300	55	10.5	0	11	425	Sulfurized lard oil
Mayco Base 1210	5500	1150	425	85	10.5	0	12	440	Sulfurized lard oil
Base 10L	6100	1155	425	85	10	0	25	350	Sulfurized fatty compound
Doverlube LCS-10	257	50	59	9	10.5	0	13.6	465	Light colored sulfurized ester
Doverlube SP-44	17,000	3700	320	65	4.4	0	2	226	Sulfur/Phosphorus additive
Lard Oils and Esters – Staining to Copper									
Base 12 SE	110	20	40	5	13	3	4	350	Sulfurized methyl ester
Mayco Base 4220	650	135	80	15	18	6	1	410	Sulfurized esters
Base 107	1600	265	160	30	17	6	6	350	Sulfurized lard oil
Base 44	2800	525	175	35	14	2	170	350	Sulfurized oleic acid
Mayco Base 1362	2900	575	245	50	17.5	6	8	400	Sulfurized lard/olefin
SUL-PERM 18	3100	590	260	55	17.5	6	7	350	Sulfurized sperm oil replacement
Base A-92	3200	610	270	60	15.4	5	15	350	Sulfurized lard oil
Mayco Base 1217LV	5000	1050	335	75	17	6	10	400	Sulfurized lard/ester
Base 14L	9000	1700	525	120	13	3	26	350	Sulfurized fatty compound
Mayco Base 1214-G	9500	2300	650	140	16.5	6	11	420	Sulfurized lard oil
Olefins – Staining to Copper									
Base 401	300	55	35	8	39	22	5	400	Sulfurized hydrocarbon
Mayco Base 1535	400	90	69	11	31	20	0	360	Sulfurized hydrocarbon
Mayco Base 1540	500	100	70	15	38.5	27	0	360	Sulfurized hydrocarbon

CHLORINE ALTERNATIVES

Product	Vis @ 100°F, SUS	Vis @ 40°C, cS	Vis @ 210°F, SUS	Vis @ 100°C, cS	% Sulfur	% Active	Acid #	% Phos	Comments
Doverlube NCEP	300	65	—	—	0	N/A	10	0	S&P free vegetable oil based EP
Mayco Base CF-95	350	75	65	11	4.5	1.5	4	0	Sulfurized sulphonate
Mayco Base CF-74	550	115	95	20	2.5	0	2	0	Sulfurized sulphonate
Doverlube NCL-2	9300	2000	N/A	N/A	0	0	125	3	Phosphorus package
Klor Free 100	13,400	2900	1150	240	0	0	5	0	Polymeric ester
Mayfree 133	44,000	9500	750	160	0	0	155	4	Phosamide

OIL-SOLUBLE BOUNDARY LUBRICANTS

Product	Vis @ 100°F, SUS	Vis @ 40°C, cS	Vis @ 210°F, SUS	Vis @ 100°C, cS	Acid #	Color (ASTM)	Comments
Methyl Ester 165	42	5	32	2	1	1	Methyl esters of vegetable oils
Maylube E-190	43	5	32	2	1.5	0.5	Synthetic ester with excellent wetting properties
Maylube E-101	95	20	35	5	2	0.5	Tridecyl stearate ester for aluminum machining
Maylube E-112	105	25	32	5	9	2.5	Neopentyl glycol ester for HP aluminum cutting
Prime Burning Lard Oil	195	40	55	8	1	1.5	Best for precision jobs; resistant to oxidation
EWS Lard Oil	195	40	55	8	8	2.5	Multiple uses in neat and soluble oils
No. 1 Lard Oil	195	40	55	8	30	5.5	Excellent for metal forming
EM-600	310	60	65	5	7	2	Co-emulsifier for soluble oils and semi-synthetics
EM-9400	400	80	70	15	25	1.5	Air-blown synthetic sperm oil replacement
EM 40	530	100	65	10	5	3	Modified glycerol monotallate

WATER-SOLUBLE BOUNDARY LUBRICANTS

Product	Vis @ 100°F, SUS	Vis @ 40°C, cS	Vis @ 210°F, SUS	Vis @ 100°C, cS	Acid	Color	% EP	Comments
Maylube S-003	300	65	N/A	N/A	20	5	—	Ester pkg. that brightens surface finish
Maylube S-830	1500	325	N/A	N/A	72	5.5	1.2 (P)	Performance booster for semi-synthetics
Lube Booster II	2300	490	N/A	N/A	65	4	—	Water-soluble polymer
Inversol 140	7600	1600	600	125	15	3.5	—	Complexed ester; cloud point at 140F

SEMI-SYNTHETIC CONCENTRATES

Product	Vis @ 100°F, SUS	Vis @ 40°C, cS	pH @ 5%	Acid #	Alkalinity	Comments
Maysol SSD-50	800	170	9.5	25	10	50/50 (product/water); Boron-free; general purpose
Maysol HOSS	1500	325	9.4	60	12	50/50 (product/water); high oil content; EP-fortified

SYNTHETIC COOLANTS

Product	pH (neat)	pH @ 5%	Acid #	Alkalinity	Comments
Maysyn S-168	8.7	8.3	50	8	Ready-to-relabel HD machining & grinding on ferrous and nonferrous
Maysyn S-122	9.7	9.3	73	17	Cut 60/40 (water/product) for medium duty machining of ferrous alloys

AMINE BORATE RUST INHIBITORS

Product	Vis @ 100°F, SUS	pH @ 1%	Boron %	Acid #	TBN	Comments
Mayco Base RP 8738	160	8.3	4.8	NR	145	Boric acid-amine salt; DEA free
Synkad 204	4400	9.4	4.1	NR	370	Improved boramide
Synkad 202	6300	9.6	4.4	NR	420	Cost effective boramide

FATTY ACID-BASED RUST INHIBITORS

Product	Vis @ 100°F, SUS	pH @ 1%	Alkalinity	Acid #	TBN	Comments
Mayco Base RP 8708	90	9.3	22	16	240	Excellent rust protection and hard water stability
Mayco Base RP 8765	176	7.8	20	185	236	Provides excellent rust protection plus lubricity
Synkad 828	215	8.7	22	155	250	DEA-free carboxylic acid condensate

MISCELLANEOUS

Product	Vis @ 100°F, SUS	Vis @ 40°C, cS	Vis @ 210°F, SUS	Vis @ 100°C, cS	Sulfur %	Chlorine %	Comments
Milidin GX-3	—	—	—	—	—	—	pH Buffer; rec. treat level of 2.0-2.5%
Doverflex 100	800	185	21	20	0	0	ESO for stain inhibition with CL additives
Mayco Base 930	3800	825	150	30	9	30	Stainless steel cold heading additive
Keil-Flo 150	5100	1100	560	120	0.1	0	50% active pour point depressant
Keil-Flo 195	>50,000	>10,000	4100	885	0.1	0	95% active pour point depressant

CHLORINATED ALKANES

Dover Chemical continues to be the leading producer of the most widely used extreme pressure additives — Chlorinated Alkanes. Our ability to custom-formulate unique corrosion inhibition and viscosity properties ensures our continued success as an innovative manufacturer in the industry. Paroil®, Dover Chemical's brand of liquid chlorinated alkanes, is based on the chlorination of waxes, olefins and normal paraffins. A variety of products are available with chlorine contents from 40 to 70 percent and with viscosities from 2 to 1000 poise at 25°C. Chain lengths available include MCCP, LCCP, and vLCCP.

VERY LONG-CHAIN CHLORINATED ALKANES, C21+

Product	Color, Typical Gardner (1933 Std.)	Chlorine Content % by Wt.	Specific Gravity @ 25°C	Viscosity, Poise @ 77°F	Viscosity, SUS @ 210°F	Density, Pounds per Gallon	Volatility % Loss, 24 hrs. @ 100°C	Stability JQD % HCl, 4 hrs. @ 175°C	Flash Point ° F (Cleveland Open Cup)
Paroil CW 38-AO	1	38.9	1.139	13.9	122	9.5	0.01	0.23	392
Paroil CW 40-AO	1	43.3	1.169	27.5	161	9.7	0.02	0.25	392
Paroil CW 50-AO	1	46.6	1.220	110.0	282	10.2	0.03	0.25	392

LONG-CHAIN CHLORINATED ALKANES, C18+

Product	Color, Typical Gardner (1933 Std.)	Chlorine Content % by Wt.	Specific Gravity @ 25°C	Viscosity, Poise @ 77°F	Viscosity, SUS @ 210°F	Density, Pounds per Gallon	Volatility % Loss, 24 hrs. @ 100°C	Stability JQD % HCl, 4 hrs. @ 175°C	Flash Point °F (Cleveland Open Cup)
Chloroflo 42	2	40.0	1.120	6.5	85	9.3	0.5	0.20	>450
Paroil 140	2	43.1	1.980	37.0	150	9.9	0.8	0.15	>450
Paroil 140 LV	2	43.5	1.185	30.0	140	9.9	N/A	0.20	>450
Paroil 140 LVXS	1	42.0	1.171	23.0	127	9.8	N/A	N/A	>450
Paroil 142	2-3	45.5	1.221	85.0	200	10.2	0.8	0.30	>450
Paroil 142 LV	2-3	46.1	1.201	49.0	170	10.0	0.8	0.16	>450
Paroil 145	2-3	47.3	1.235	118.0	230	10.3	0.8	0.20	>450
Paroil 150	3	51.0	1.286	375.0	444	10.7	1.0	0.50	>450
Paroil 500	4	53.2	1.309	N/A	649	10.9	N/A	N/A	>450
Chlorowax 40®	2	43.7	1.175	27.0	136	9.8	0.8	0.20	>450
Chlorowax 41SW	2	42.7	1.173	24.0	125	9.8	0.5	0.30	>450
Chlorowax 50®	3	48.0	1.230	116.0	230	10.2	0.8	0.20	>450

MEDIUM-CHAIN CHLORINATED ALKANES, C14: C14-C16

Product	Color, Typical Gardner (1933 Std.)	Chlorine Content % by Wt.	Specific Gravity @ 25°C	Viscosity, Poise @ 77°F	Viscosity, SUS @ 210°F	Density, Pounds per Gallon	Volatility % Loss, 24 hrs. @ 100°C	Stability JQD % HCl, 4 hrs. @ 175°C	Flash Point °F (Cleveland Open Cup)
Paroil DO-152	1	50.7	1.269	9.8	63	10.6	N/A	N/A	>392
Paroil 10-NR	<1	40.1	1.102	0.4	37	9.2	0.8	0.2	>350
Paroil 45	1	47.2	1.203	1.9	48	10.0	1.5	0.2	>400
Paroil 152	1	51.9	1.27	15.0	69	10.6	0.9	0.3	>450
Paroil 51-NR	2	50.1	1.228	5.8	57	10.2	N/A	0.2	>450
Paroil 53-NR	1.8	52.9	1.270	15.0	69	10.6	1.0	0.3	>450
Paroil 54-NR	1	55.3	1.294	17.8	75	10.8	N/A	0.2	>450
Paroil 56-NR	1	56.9	1.327	119.0	119	11.1	N/A	0.3	>450
Paroil 58-NR	2	59.0	1.380	300.0	176	11.5	0.5	0.3	>450
Paroil 63-NR	1	63.6	1.439	450.0	314	12.0	0.5	0.2	>450

CHLORINATED FATTY COMPOUNDS

Product	Material	Color, Typical Gardner	Chlorine Content % by Wt.	Specific Gravity @ 50°C	Viscosity, SUS @ 100°F	Viscosity, SUS @ 210°F	Viscosity, Poise @ 25°C	JQD % HCl, 4 hrs. @ 175°C
DA-8506	Chlorinated Methyl Ester	3	35	1.14	950	752	6	0.5
DA-8527	Chlorinated Fatty Acid	3	29	1.09	1800	110	12	4

FLAME RETARDANTS

HORDARESIN AND CHLOREZ®

Hordaresin and Chlorez® are the brand names for Dover Chemical's line of resinous chlorinated alkanes. These products are tasteless and odorless chlorinated alkane resins especially soluble in aromatic and chlorinated solvents. They have limited or no solubility in lower alcohols, glycols, glycerines, and water. They provide low-cost flame retardancy for a wide variety of applications.

Hordaresin and Chlorez are compatible with most commonly used resins, rubbers, plasticizers, waxes and drying oils. Because of their very high active halogen content and low cost, these products find wide usage as flame retardant additives in coatings, inks, plastics, foams, adhesives, paper and fabrics.

DOVERGUARD

Dover Chemical Corporation has developed a group of products based on the bromination and chlorination of a variety of olefins. Each has been developed to meet specific end-use needs. These products also can be compounded into a variety of polymer systems to provide efficient use of synergists.

DOVERSPERSE

Both Doversperse A-1 and Doversperse 3-NR typically contain 45% available chlorine for maximum flame retardant efficiency. Because of their non-ionic base they find application in both cationic and anionic emulsion systems.

In addition to their flame-retardant contribution, they improve adhesion, impact chemical and water resistance and allow the user to formulate aqueous systems rather than solvent systems. Doversperse A-1 is recommended if increased hardness is required. Use Doversperse 3-NR for plasticizing and tackifying. Application areas include adhesives, rubber, coatings, inks, carpet backings, and paper-and-fabric coatings.

Lab tests with and without flame-retardant additives prove their effectiveness.

HORDARESIN AND CHLOREZ®

Resinous Chlorinated Flame Retardants

Product	Color, APHA	% Chlorine	Specific Gravity @ 25°C	Bulk Density, g/l	Particle Size, % thru 297 Micron	% Volatiles	Softening Point, °C	Heat Stability, % HCl	Physical Form
Chlorez 700	130	70.8	1.6	1,619	96	<0.1	102	<0.1	White Powder
Hordaresin NP-70	105	71	1.6	1,619	96	<0.1	102	0.01	White Powder
Chlorez 700-S	100	70.8	1.6	1,619	96	<0.1	102	0.05	White Powder
Hordaresin CH-151-P	100	71.1	1.6	1,619	87	<0.1	102	<0.01	White Powder
Chlorez 700-SS	100	71.5	1.6	1,619	N/A	<0.1	102	0.01	White Powder

DOVERGUARD LIQUID BROMINATED AND BROMOCHLORINATED FLAME RETARDANTS

Product	Color, Gardner	Poise @ 25°C	% Bromine	% Chlorine	Specific Gravity @ 50°C
Doverguard 8207-A	3	25	30	31	1.400
Doverguard 8408	2	2	31	23	1.325

DOVERSPERSE AQUEOUS FLAME RETARDANTS

Dover offers two aqueous flame retardant systems:

- Doversperse A-1 is a dispersed solid and is used to flame-retard coatings and textiles.
- Doversperse 3-NR is an emulsion based on a high viscosity liquid and is typically used to flame-retard adhesive systems.

Product	% Solids	Poise @ 25°C	% Chlorine	Specific Gravity @ 25°C	Appearance
Doversperse A-1	65	64 [1]	45	1.60	Cream White
Doversperse 3-NR	66.5	150-300 [2]	40	1.54	Cream White

[1] #5 spindle, 20 rpm [2] #6 spindle, 10 rpm

STEARATES

Doverlube metallic stearates are recommended as a general lubricating additive in plastics processing; internal lubricating properties ease extrusion and mold flow of many plastics compounds. They are also used as mold release agents, preventing preforms from delaminating, reducing adhesion of compounds to inside surfaces of molds and increasing mold life. Metallic stearates provide excellent resistance to color degradation at elevated temperatures, and are particularly suitable as internal lubricants and mold release agents where higher-than-usual processing temperatures are encountered. Metallic stearates are recommended for maximum clarity in unpigmented PVC and polystyrene compounds, and minimize "plate-out" tendencies in PVC extrusion compounds. They increase water repellence of concrete, cement, stucco washes, magnesite and fiberboard, and impart water resistance to asbestos, paper stocks, boxboard, cardboard, textiles and explosives used in mining.

Product	% Total Ash (as CaO)	% Free Fatty Acid	% Moisture	Melt Point, °C	Apparent Density (lb/ft3)	% Passing thru #20 US Mesh	% Passing thru #100 US Mesh	% Passing thru #200 US Mesh	% Passing thru #325 US Mesh
Doverlube CA-20	11.4	1.0 max.	3.5 max.	152	41	95 min.	20 max.	—	—
Doverlube CA-21	11.4	1.0 max.	3.5 max.	152	15	—	—	95 min.	—
Doverlube CA-22	10.5 – 12.0	1.0 max.	3.5 max.	152	15	—	—	—	99 min.
Doverlube ZN-20	13.5	1.0 max.	0.5 max.	121	37	—	20 max.	—	—
Doverlube ZN-22	13.5	1.0 max.	0.5 max.	121	21	—	—	—	95 min.

Dover Chemical Corporation's Calcium Stearate products are NSF Certified.

PIBSA | PIBSI

Dover Chemical's PIBSA plant, ideally located at our Hammond, Indiana site, was built to be flexible and efficient. Dover Chemical makes a full line of Polyisobutylene Succinic Anhydride (PIBSA), so ask us first. Dover Chemical is not limited on PIB molecular weight; we will process PIB up to 2300 molecular weight, which makes Dover Chemical as flexible as your product line. We utilize the thermal process to convert PIB and maleic anhydride to PIBSA, so residual chlorine is not a concern.

High reactive or conventional based PIBSA — because Dover Chemical has a reliable supply of both plus naphthenic oil, neutral oil, solvent dilution. Need to go beyond just PIBSA? Dover Chemical has multiple capabilities to produce a variety of PIBSA derivatives. Our full support Research and Development team can help optimize your molecule.

Dover Chemical is here to help the niche market make their good idea work, and for the mass producer needing some additional capacity. We can fill a drum, tote, tankwagon, isotainer or a railcar.

Product	Physical Form	Acid Value, mgKOH/g	Free Maleic Acid, %	Viscosity, cSt @ 100°C	Hydrolysis, %	Residual Chlorine
Dovermulse H-1000	Dark amber/ brown viscous liquid	54	<0.50	470	<5.0	<0.01
Dovermulse H-1013P	Thick amber liquid	50	0.25	290	<5.0	<0.01
Dovermulse H-1020P	Thick amber liquid	46	0.25	220	≤5.0	<0.01
Dovermulse H-1035N	Thick amber liquid	34	0.25	74	≤5.0	<0.01
Dovermulse H-1335P	Thick amber liquid	29	0.25	140	<5.0	<0.01

Product	Physical Form	TBN	% N	Viscosity, cSt @100°C	Specific Gravity
Doversperse H-1015P	Dark amber/ brown viscous liquid	77	3.2	450	0.92
Doversperse H-1035P	Dark amber/ brown viscous liquid	62	2.2	160	0.091

DRILLING MUD ADDITIVES

Whether you're drilling at 100° F or –20° F, using oil based mud, synthetic based mud, water based mud or brine, there is a Dover lubricant that will improve the rate of penetration on your vertical drill, reduce torque and reduce drag on the difficult horizontal drill.

Doverlube lubricants can withstand the high temperature and high pressure demands of horizontal drilling, and provide unmatched lubricity for Coil Tubing applications.

Product	Color	Viscosity @ 100°F	Acid Value, mgKOH/g	Flash Point, C.O.C. °F	Pour Point, °C	Density
Doverlube DFA-0938	Dark Brown	115	4.4	>350	16	8.0
Doverlube DFA-0938W	Dark Brown	76	4.0	320	-10	7.5
Doverlube DFA-0938XW	Dark Brown	70	1.8	320	-20	7.5
Doverlube DFA-1010	Dark Brown	5800	27	>350	18	8.3
Doverlube DFA-1121	Dark Brown	55	<25	>390	-20	7.7
Doverlube DFA-1208	Dark Brown	120	8 max.	>350	16	8.4
Doverlube DFA-1535	Dark Brown	420	3	>360	-30	8.5
Doverlube DFA-24-4	Dark Brown	925	7.0	>380	35	9.1
Doverlube DFA-4414	Dark Brown	2775	170	>350	18	8.4
Doverlube DFA-600	Amber	61	7.0	350	18	8.7

TECHNICAL ASSISTANCE

Dover Chemical Corporation has state-of-the art research and quality-control laboratories. This facilitates the development of new products and enables us to prove a product's ability to perform as required. These modern facilities, complemented by our ISO 9001 Certification, assure consistent and continuing conformance to ever-changing needs. The following is a sampling of the capabilities of our technical and quality departments.

ANALYTICAL

- FTIR—Fourier Transform Infrared Spectroscopy
- DSC—Differential Scanning Calorimetry
- TGA—Thermal Gravimetric Analysis
- GC—Gas Chromatography
- GC/MS—Gas Chromatography / Mass Spectrometry
- GPC—Gel Permeation Chromatography
- HPLC—High Pressure Liquid Chromatography Colorimetry
- LC-MS—Liquid Chromotography– Mass Spectrometry
- ICP-OES—Inductively Coupled Plasma—Optical Emission Spectrometry

PHYSICAL ANALYSIS

- Acid Number
- Color Determination
- Viscosity Measurement
- Chlorine Content
- Phosphorus Content
- Softening Point— Ring & Ball Method
- Specific Gravity
- Particle Size
- Stability Test
- Volatility Test
- Flash Point
- Corrosion Test
- Ash Content
- Iron Content
- Ofite Lubricity Tester
- Fann Viscometer
- Fluid Loss Apparatus
- Emulsion Stability Meter

PROCESSING

- 1 Roll Mill
- Boy Injection Molder
- Sheets & Pellet Extrusion
- RC-1 Mettler Reactor Colorimeter
- NFM—26mm co-rotating twin screw extruder
- Brabender—18mm single screw extruder
- Brabender—18mm conical counter rotating twin screw extruder
- Brabender—18mm co-rotating twin screw extruder
- 2 Brabender—3 piece bowl mixers
- Wabash—Compression Molder

PHYSICAL, MECHANICAL, FLAMMABILITY

- Instron—Flex and Tensile
- Izod Impact Tester
- Falling Dart Impact Tester
- Vicat Softening Point
- Heat Deflection
- QUV—Weathering Test
- Oxygen Index Tester
- UL-94 Flammability Cabinet
- Polymer Melt Flow
- Falex Pin & V-Block Friction and Wear Tester
- Microtap Tapping Torque
- Custom Designed Drawbead Apparatus
- Four Ball Wear Test Machine
- Bridgeport CNC Machining Center

SERVICE

Focusing Extraordinary Resources on Customer Needs

Dover Chemical Corporation is uniquely equipped to provide timely solutions to your needs for chlorinated alkanes, organophosphites, brominated compounds, flame retardants, antioxidants, lubricant additives and drilling-fluid additives.

Total Quality is assured from product development through actual production. Our research center, with state-of-the-art equipment , is able to develop new products to perform to your specifications. This modern facility, complimented by our ISO 9001 certification, means consistent, continuing conformance to your ever-changing needs.

Demanding "just-in-time" delivery schedules are not a problem with Dover Chemical. We are dedicated to anytime delivery – nights, days, weekends, whenever you need our products—allowing you to eliminate costly inventory warehousing while still meeting your own production requirements.

The bottom line of our customer service advantage is our people. People with the knowledge and flexibility to make sure you obtain the timely chemical solutions you need.

DOVER Chemical Corporation
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DOVER Chemical Corporation
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ISO 9001 Certified

American Chemistry Council

Certification No. QSR-130

Responsible Care
Our Commitment to Sustainability

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