



Understanding Biocides

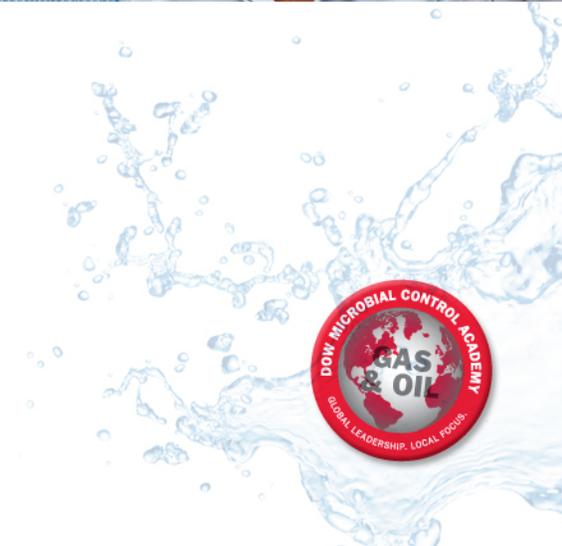
Biocides: What they are, what they do and why they matter





What are biocides?

- Biocides are a common part of everyday life
- They are chemical agents used to kill harmful microorganisms in order to:
 - Preserve health
 - Protect product integrity
- Also known as antimicrobials, pesticides or algicides



What are biocides?

- Many familiar products have biocidal properties and uses:
 - Bleach
 - Ethyl alcohol
 - Iodine
 - Peroxide
 - Salt



Where can biocides be found?

- Biocides are used in:
 - Household cleaners
 - Personal care products
 - Paint
 - Plastics



Why are biocides used in everyday products?



- To fight mold
- To prevent spoilage
- To keep people and their surroundings healthy



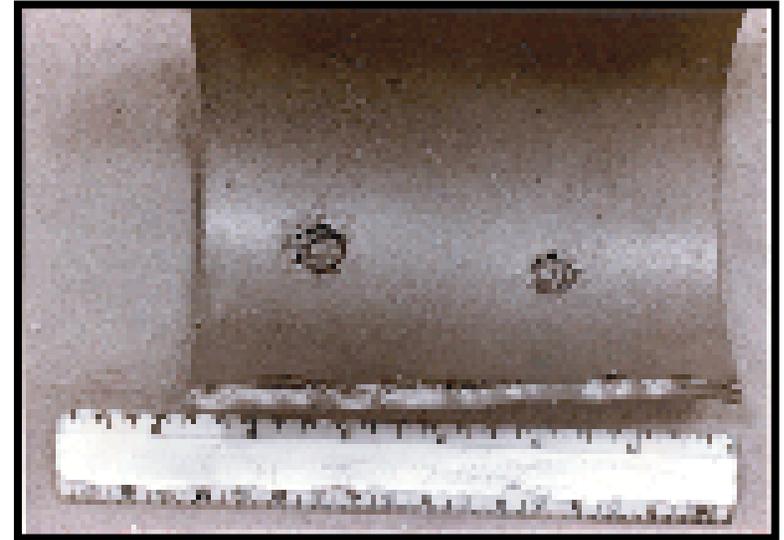
Why are biocides used in gas and oil production?

- Reduce corrosion
- Combat souring
- Promote optimum production rates
- Protect functional fluids from spoilage

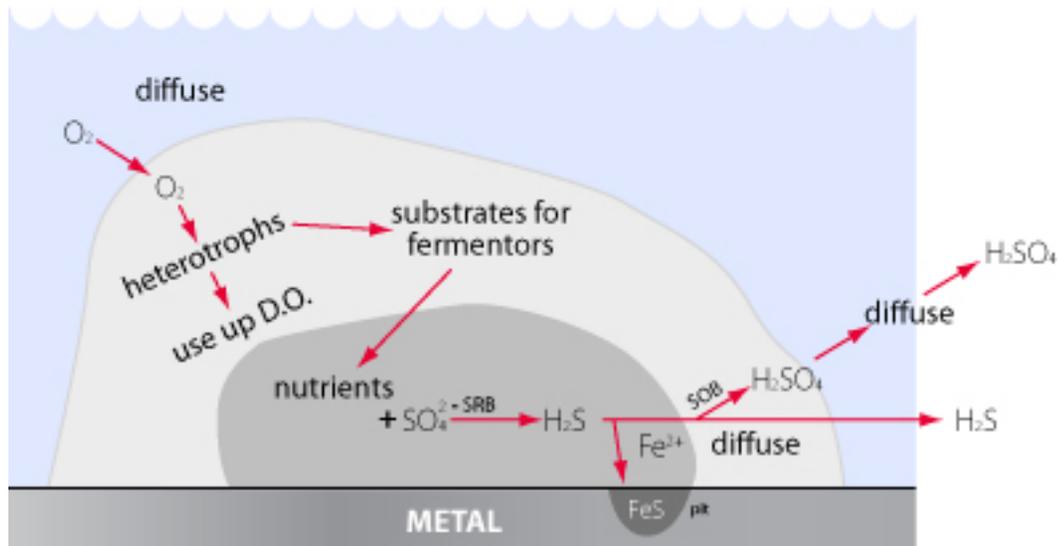


Why are biocides used in gas and oil production?

- To combat Microbially Influenced Corrosion (MIC)
 - Helps protect the integrity of equipment and pipelines
 - Ensures that human and environmental health and safety are maintained



Biofilm Microenvironments



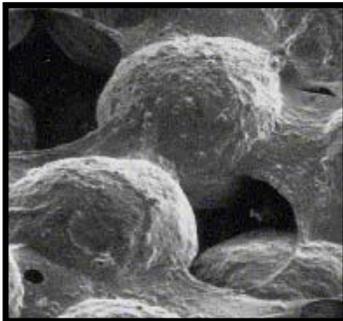
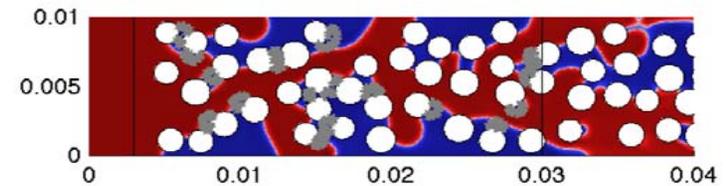
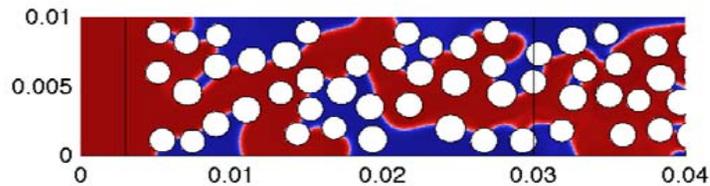
Why are biocides used in gas and oil production?

- Bacteria in some wells and storage areas produce hydrogen sulfide (H_2S)
 - H_2S smells like rotten eggs, can be flammable and possibly explosive
- Biocide treatments control the bacteria that produce H_2S



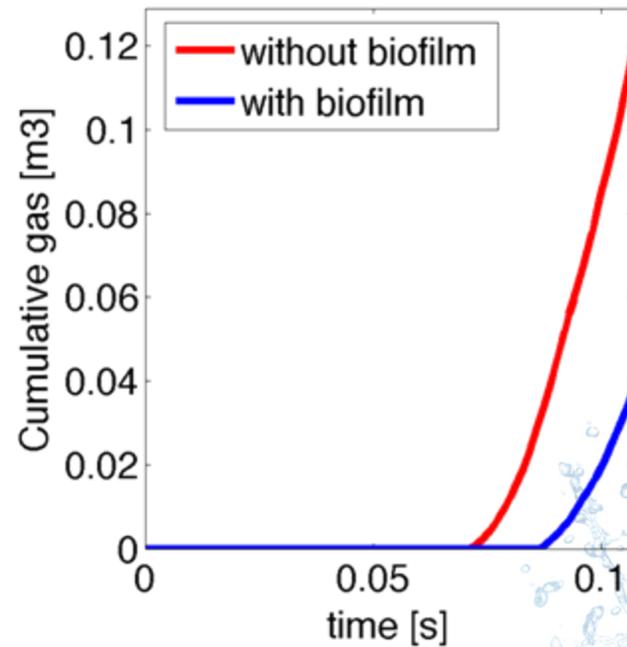
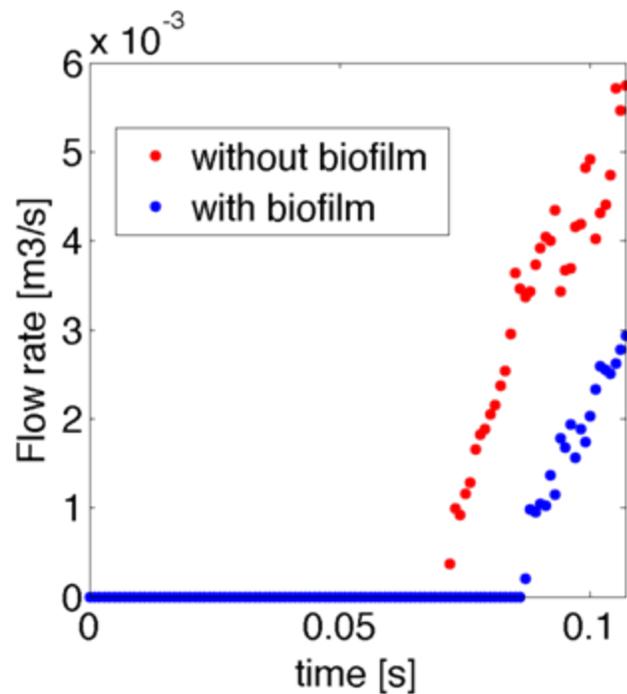
Why are biocides used in gas and oil production?

- To promote optimum production rates
 - Biofilm can cause plugging
 - Small amounts of biofilm can greatly affect flow paths



Why are biocides used in gas and oil production?

Flowrate comparisons



Who makes biocides?

- Biocide manufacturers are major companies



Lonza



- They are responsible for federal registration of:
 - Chemical properties
 - Degradation data
 - Environmental impact assessments



Who applies biocides?

- Biocides are applied by
 - Professional service companies
 - Rigorously trained engineers
- They are applied per EPA-approved instructions
- Dow customers must display robust stewardship practices



Who regulates biocides?

- The federal laws that govern the use of herbicides and insecticides on food crops also apply to biocides
- EPA registration is required
- EPA-approved label instructions are required for use and dosage
- Registration with state agencies under state laws is required



Example of EPA Approved Label

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS AND DOMESTIC ANIMALS
DANGER
KEEP OUT OF REACH OF CHILDREN

Corrosive. Causes irreversible eye damage. Causes skin irritation. Harmful if inhaled. Harmful if swallowed. Harmful if absorbed through skin. Preformed or

AQUCAR™ GA 25

Water Treatment Microbiocide

A highly effective Microbiocide for use in controlling Bacteria Including Slime Forming Bacteria and Sulfate-Reducing Bacteria, Fung (Yeast and Molds) and Algae in Air washers and Industrial Scrubbing

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.

AIR WASHERS AND INDUSTRIAL SCRUBBING SYSTEMS/
RECIRCULATING COOLING AND PROCESS WATER SYSTEMS

This product may be used only in industrial washers and air washers for the control of bacteria, fungi, and algae. It is not intended for use in domestic or agricultural applications.

AQUCAR GA 25 Water Treatment Microbiocide should be added to the circulating water in the system at a concentration of 100 to 2,000 ppm (0.4 to 7.9 gallons of AQUCAR GA 25 Water Treatment Microbiocide per 100 gallons of water).

DRILLING, COMPLETION, AND WORKOVER FLUIDS

AQUCAR GA 25 Water Treatment Microbiocide should be added to a drilling fluid system at a point of uniform mixing such as the circulating mud tank.

Initial Treatment: Add 100 to 2,000 ppm AQUCAR GA 25 Water Treatment Microbiocide (0.4 to 7.9 gallons AQUCAR GA 25 Water Treatment Microbiocide per 100 barrels of fluid) to a freshly prepared fluid depending on the severity of contamination.

Maintenance Dosage: Maintain a concentration of 100 to 2,000 ppm AQUCAR GA 25 Water Treatment Microbiocide by adding 0.4 to 7.9 gallons of AQUCAR GA 25 Water Treatment Microbiocide per 100 barrels of additional fluid

STORAGE AND DISPOSAL

PESTICIDE DISPOSAL: Do not contaminate water, food or feed by storage or disposal. Open dumping is prohibited. Pesticide wastes are toxic. Improper disposal of excess pesticide, spray mixture or residue is a violation of Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or your Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

CONTAINER DISPOSAL: Metal Containers: Triple rinse (or equivalent). Then offer for recycling or reconditioning or purchase and dispose of in a sanitary landfill, or other procedures approved by state and local authorities. Plastic Containers: May be incinerated, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke. Metal Containers: Must not be recycled. Do not put in or near metal containers.

NOTICE

Do Not Ship or Store with Food, Feeds, Drugs, or Clothing

CONTAINER SIZE

CONTAINER SIZE	CONTAINER SIZE	CONTAINER SIZE
55 GALLONS	55 GALLONS	TOTE
44 POUNDS	486 POUNDS	2,316 POUNDS
NET WEIGHT	NET WEIGHT	NET WEIGHT

IN CASE OF AN EMERGENCY endangering life or property involving this product, call collect (888) 636-4400.

Example of EPA Approved Label

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS AND DOMESTIC ANIMALS
DANGER
KEEP OUT OF REACH OF CHILDREN
 Corrosive. Causes irreversible eye damage. Causes skin irritation. Harmful if inhaled. Harmful if swallowed. Harmful if absorbed through skin. Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals. Causes asthma signs and symptoms in type-reactive individuals.

Do not get in eyes, on skin, or on clothing.
 Avoid breathing vapor. Do not swallow.
 Wear goggles, protective clothing, and built or nitrile gloves.
 Wash thoroughly with soap and water after handling.
 Remove contaminated clothing and wash before reuse.

ENVIRONMENTAL HAZARDS
 This pesticide is toxic to fish. Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans or other waters unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent containing this product to sewer systems without previously notifying the local sewerage treatment plant authority. For guidance, contact your State Water Board or Regional Office of the EPA.

STORAGE AND HANDLING
 AQUICAR GA 25 Water Treatment Microbicide is incompatible with many commonly used materials of construction such as steel, galvanized iron, aluminum, tin, and zinc. AQUICAR GA 25 Water Treatment Microbicide can be stored and handled in baked phenolic-lined steel, polyethylene, stainless steel, reinforced epoxy-plastic equipment. This product freezes at about 14°F (-10°C). Therefore, unless the storage tanks is inside or underground heating and insulation may be required. If heating is needed, exposure to high temperatures should be avoided. For short storage times (up to about 1 month), temperatures up to 90°F (32.2°C) can be tolerated but the preferred maximum storage temperature is about 80°F (26.7°C).

A stainless steel centrifugal pump is suggested for transfer service. Spin-on sand stainless steel with TEFLOM™ Polymer is suitable for gaskets and packings.

Handle in a well-ventilated area. If vapors are irritating to the nose or eyes, special ventilation or respiratory protection (MSHA/NIOSH approved purifying respirator equipped with an organic vapor cartridge) may be required.

LIMITED WARRANTY AND DISCLAIMER
 Seller warrants that the product conforms to its chemical description as contained on this label and is reasonably fit for the purposes stated on this label when used in accordance with the directions under normal conditions of use. THE WARRANTIES MADE IN THIS PARAGRAPH ARE SELLER'S SOLE WARRANTIES WITH RESPECT TO THE PRODUCT AND ARE MADE EXPRESSLY IN LIEU OF AND EXCLUDE ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE AND ALL OTHER EXPRESS OR IMPLIED REPRESENTATIONS AND WARRANTIES.

BEFORE HANDLING OR USING THIS PRODUCT, SEE YOUR EMBROIDERED SAFETY DATA SHEET.

STORAGE AND DISPOSAL
PESTICIDE DISPOSAL: Do not contaminate water, food or feed by storage or disposal. Open dumping is prohibited. Pesticide wastes are toxic. Improper disposal of excess pesticide, spray mixture or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or your Environmental Control Agency, or the nearest EPA representative at the nearest EPA Regional Office.
CONTAINER DISPOSAL: Metal Containers: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or other procedures approved by state and local authorities. Plastic Containers: May be incinerated, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke. Metal Containers: Must not be incinerated. Do not cut or weld on or near metal containers.

NOTICE
 Do Not Ship or Store with Food, Feeds, Drugs, or Clothing

STORAGE AND DISPOSAL

Handle in a well-ventilated area. If vapors are irritating to the nose or eyes, special ventilation or respiratory protection (MSHA/NIOSH approved air purifying respirator equipped with an organic vapor cartridge) may be required.

PESTICIDE DISPOSAL: Do not contaminate water, food or feed by storage or disposal. Open dumping is prohibited. Pesticide wastes are toxic. Improper disposal of excess pesticide, spray mixture or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or your Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

STORAGE AND HANDLING

CONTAINER DISPOSAL: Metal Containers or Plastic Containers: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or other procedures approved by state and local authorities. **Plastic Containers:** May be incinerated, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke. **Metal Containers:** Must not be incinerated. Do not cut or weld on or near metal containers.

EPA Reg. No. 494-638
 EPA Est. No. 10352-WW-2 (A, 494-WW-1 #)
 (A) 5 gallon plastic pails, all drums, bulk
 (B) Sample, 5 gallon plastic jugs, then full
 pallet

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 Midland, Michigan 48674 U.S.A.
 (989) 636-1400
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 ("Dow") or an affiliated company of Dow
 Made in U.S.A.

Net Contents: 5, 55 gallons or bulk

CONTAINER SIZE	CONTAINER SIZE	CONTAINER SIZE
5 GALLONS	55 GALLONS	TOTE
44 POUNDS	486 POUNDS	2,316 POUNDS
NET WEIGHT	NET WEIGHT	NET WEIGHT

WATER FLOODS
 AQUICAR GA 25 Water Treatment Microbicide should be added to a water flood system at a rate of 0.001 parts per million.

Label Statement: See the product label for complete instructions. Do not use AQUICAR GA 25 Water Treatment Microbicide for use in a water flood system. AQUICAR GA 25 Water Treatment Microbicide is not for use in a water flood system. Subsequent to use, the water flood system should be flushed with clean water. AQUICAR GA 25 Water Treatment Microbicide should be added to a water flood system at a rate of 0.001 parts per million.

IN CASE OF AN EMERGENCY endangering life or property involving this product, call collect (989) 636-4400.

How are biocides evaluated?

- Different models exist for different organizations
 - EPA, FDA, European and Asian regulators
 - Personal Care Products Council
 - Many more government and industry groups
- Multiple factors include:
 - Usage rates
 - Degradation profile
 - Exposure levels
- Models replicate “real world” conditions



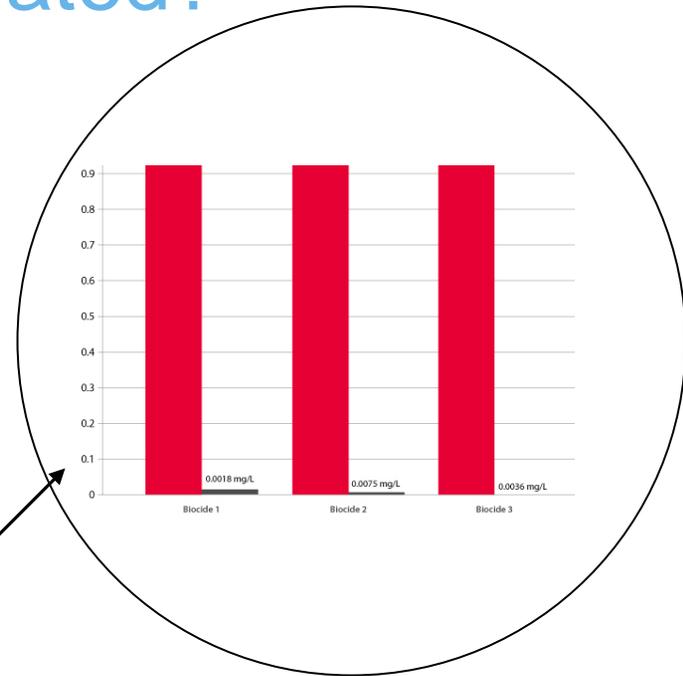
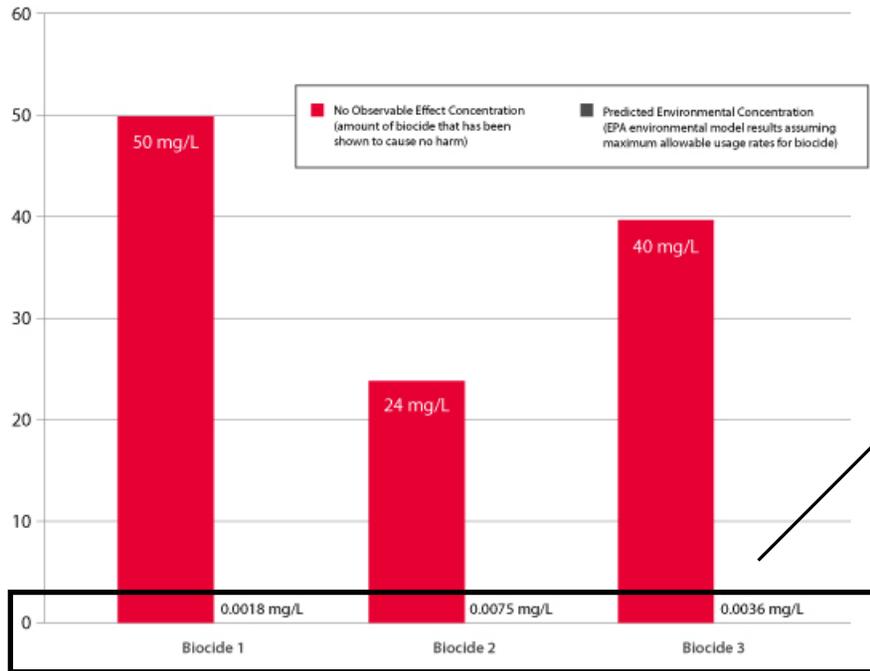


How are biocides evaluated?

- U.S. EPA evaluates risk by calculating the margin of exposure
- Usage levels, degradation and safety factors are applied
 - Possible exposure levels must fall below levels of concern



How are biocides evaluated?



Residual biocide levels after treatment in gas and oil applications are greater than 2,500 times less than the no observable effect concentrations.



How are biocides evaluated?

- HOCNF uses similar modeling techniques
 - Emphasizes protecting marine life
 - The rating system is not limited to biocides
 - Many biocides perform well due to inherent degradability

Ratings of Dow Microbial Control Products for North Sea Gas Production by UK

Product	Rating
AQUCAR™ IG-E 50	Gold
SUMP BUDDY* WT	Silver
UCARCIDE™ 24	Gold
ANTIMICROBIAL 7287	Silver
UCARCIDE™ 50	Gold

UK Hazard Quotient Key

HQ Range	Rating
<1	Gold
1-30	Silver
30-100	White
100 – 300	Blue
300 – 1000	Orange
>1000	Purple



Summary

- Biocides play a key role in everyday life
- They serve an important function in safe and efficient hydrocarbon production
- They are strictly regulated by federal, state and international authorities
- Dow Microbial Control follows strict rules of stewardship, focusing on safety, human health and environmental sustainability





Microbial Control

Thank You!

