



# 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



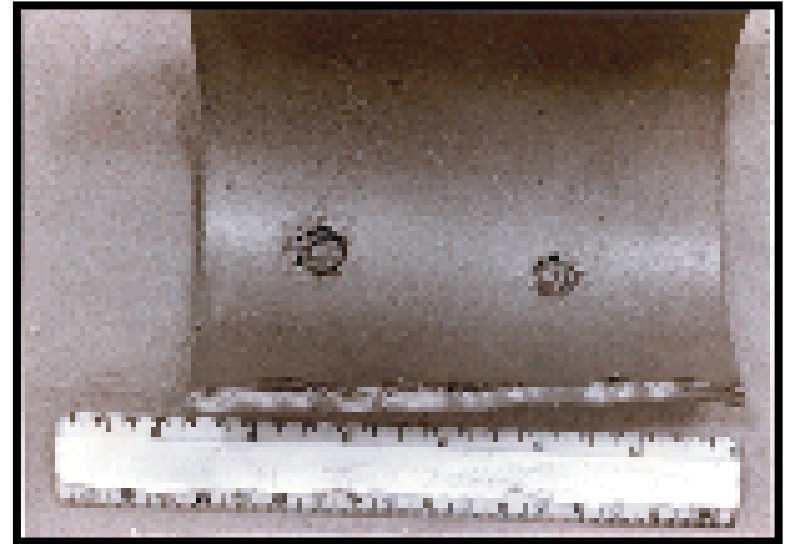
# Why are biocides used in gas and oil production?

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

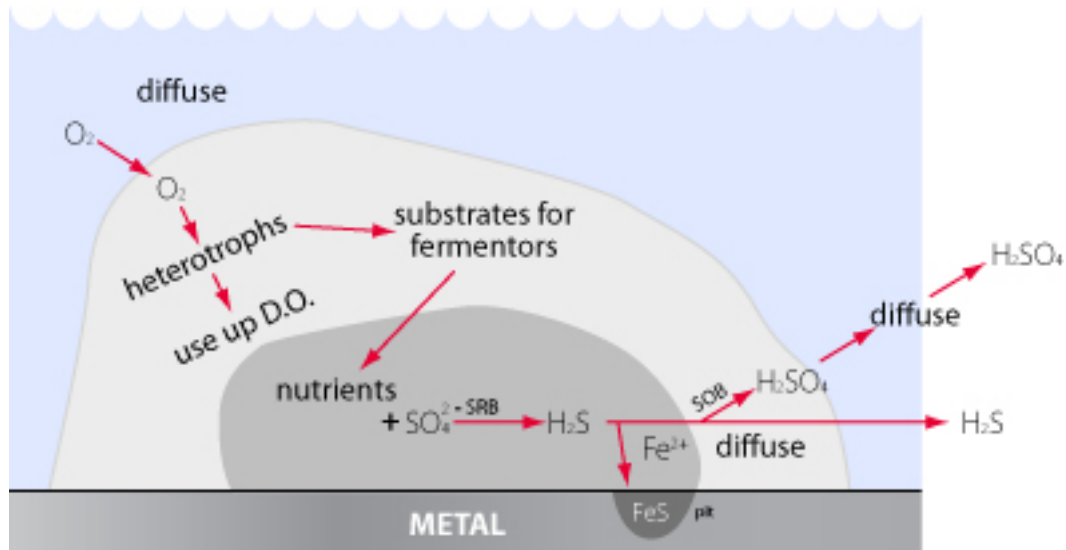


# Why are biocides used in gas and oil production?

- 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







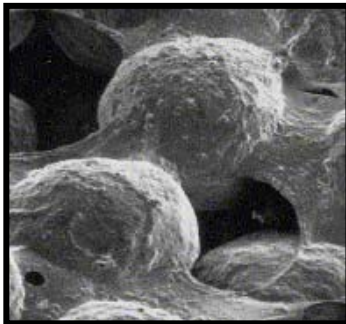
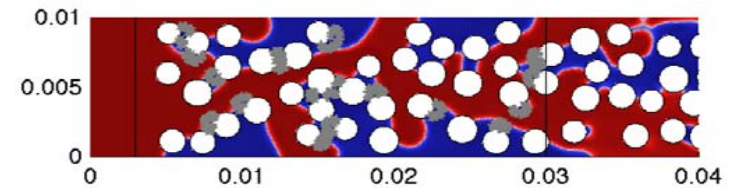
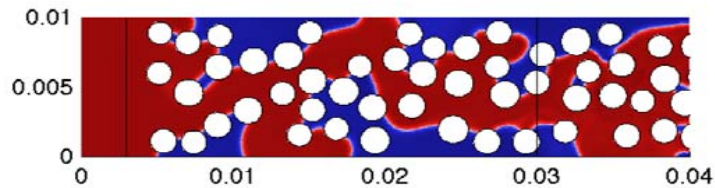
# Why are biocides used in gas and oil production?

- 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  $H_2S$



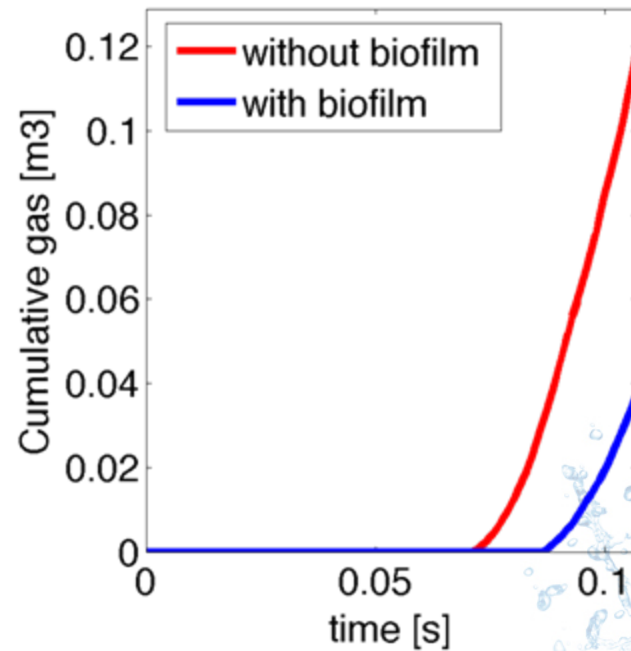
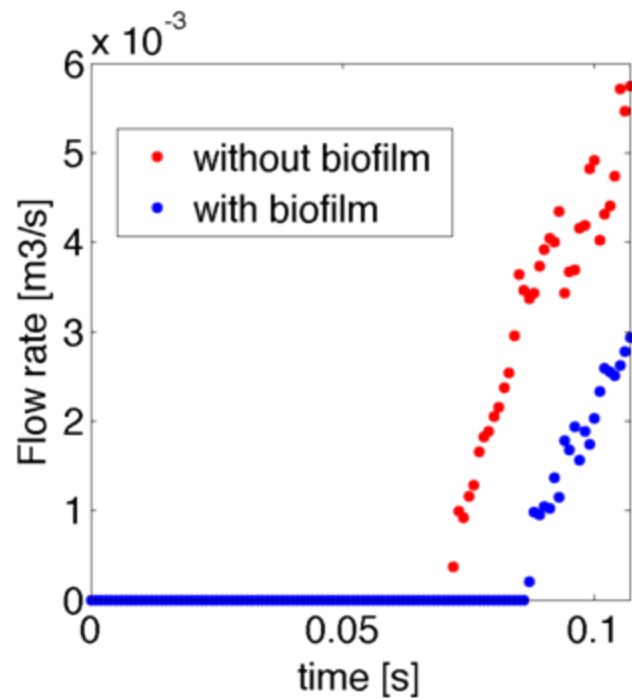
# Why are biocides used in gas and oil production?

- 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. Prolonged or frequently repeated skin contact may cause skin 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 a buff 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 sewage treatment plant authority. For guidance, contact your State Water Board or Regional Office of the EPA.

**STORAGE AND HANDLING**  
 AQUICAR GA 25 Water Treatment Microbiocide is incompatible with many commonly used materials of construction such as steel, galvanized iron, aluminum, tin, and zinc. AQUICAR GA 25 Water Treatment Microbiocide can be stored and handled in labeled plastic and steel, polyethylene, aluminum, or reinforced epoxy-plastic equipment. This product freezes at about 14°F (-10°C). Therefore, unless the storage tanks are inside or underground, heating and insulation may be required. If heating is needed, exposure to high temperatures should be avoided. For steel storage lines (up to about 100 ft), temperatures of up to 100°F (38°C) can be tolerated but the preferred maximum storage temperature is about 80°F (28°C).

A stainless steel centrifugal pump is suggested for transfer service. Spiral-wound stainless steel with TEFLO<sup>®</sup> Polymer is suitable for gaskets and packing.

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.

**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 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 FITNESS FOR AN PARTICULAR PURPOSE AND ALL OTHER EXPRESS OR IMPLIED REPRESENTATIONS AND WARRANTIES.

**BEFORE HANDLING OR USING THIS PRODUCT, SEE YOUR EMPLOYER AND READ CURRENT MATERIAL 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 empty container 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 or Plastic 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 reuse or refill any metal container.

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

## AQUICAR™ 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 Mold) and Algae In Air Washers and Industrial Scrubbing Systems, Recirculating Cooling and Process Water Systems including those that contain Reverse Osmosis Membranes and Service Water and Auxiliary Systems, Heat Transfer Systems, Wastewater Systems Including Wastewater Sludge and Holding Tanks, Paper Mills and Paper Mill Process Water Systems, Pigments and Filler Slurries for Paper and Paperboard, Water Based Coatings for Paper and Paperboard and In Oil Well Drilling, Oil Field Processing Applications, Oil Field Water Systems, Gas Production and Transmission Pipelines and Systems, and Gas Storage Tanks and Equipment, such as Steam-Injection Water Holding Tanks, Flood Water, Injection Water, Holding Pond Water, Disposal-Water, Water Holding Tanks, Fuel Storage Tanks and related Refinery and Oil Field Closed, Industrial Recirculating Water Handling Systems.

Active Ingredient: Glutaraldehyde 25%  
 Inert Ingredients 75%  
 Total 100%

## KEEP OUT OF REACH OF CHILDREN DANGER FIRST AID

If swallowed:  
 • Call a poison control center or a doctor immediately for treatment advice.  
 • DO NOT INDUCE VOMITING.  
 • Do not give anything to drink.

If in eyes:  
 • Wash immediately and continuously with flowing water for at least 30 minutes.  
 • Remove contact lenses after 15-30 minutes unless otherwise advised. Obtain prompt medical consultation, preferably from an ophthalmologist.  
 • Call a poison control center or a doctor immediately for treatment advice.  
 • Get skin or clothing:  
 • Take off contaminated clothing.  
 • Rinse skin immediately with plenty of water for 15-20 minutes.  
 • Call a poison control center or a doctor for treatment advice.

If inhaled:  
 • Move person to fresh air.  
 • If person is not breathing, call 911 or an ambulance, and then give artificial respiration, preferably from a mouth-to-mouth if possible.  
 • Call a poison control center or a doctor for further treatment advice.

**NOTE TO PHYSICIAN:** Aspiration may cause lung damage. Probable mucosal damage may contraindicate the use of gastrointestinal agents.  
 Have the MSDS and, if available, the product container or label with you when calling a poison control center or a doctor, or going for treatment.

SEE SIDE PANEL FOR ADDITIONAL PRECAUTIONARY STATEMENTS

EPA Reg. No. 494-688  
 EPA Est. No. 10352-WW-2 (A)-494-WV-1 (A)  
 (A) 5 gallon pails in pairs; all drums, bulk  
 (B) Sample, 5 gallon pails (see full label)

  
**The Dow Chemical Company**  
 Midland, Michigan 48674 U.S.A.  
 (989) 636-1400

©TM Trademark of The Dow Chemical Company  
 ("Dow") or an affiliated company of Dow  
 Made in U.S.A.

Net Contents: 5, 55 gallons or bulk

| CONTAINER SIZE<br>5 GALLONS | CONTAINER SIZE<br>55 GALLONS | CONTAINER SIZE<br>TOTE     |
|-----------------------------|------------------------------|----------------------------|
| 44 POUNDS<br>NET WEIGHT     | 486 POUNDS<br>NET WEIGHT     | 2,316 POUNDS<br>NET WEIGHT |

### DIRECTIONS FOR USE

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

**AIR WASHERS AND INDUSTRIAL SCRUBBING SYSTEMS/RE-CIRCULATING COOLING AND PROCESS WATER SYSTEMS**  
 This product may be used only in industrial water and air water systems which have sufficient circulation.

**AQUICAR GA 25 WATER TREATMENT MICROBICIDE** should be added at the application rate indicated below to service treatment systems at constant flow or cyclic flow such as air wash tanks and air wash scrubbers (see label for details) or continuously. Single batch addition can be shock treated with AQUICAR GA 25 Water Treatment Microbiocide. Maximum contact, maximum effect is obtained by 14-21 days.

**AQUICAR GA 25 WATER TREATMENT MICROBICIDE** may be used in recirculating systems where the water is continuously recirculated and the recirculation rate is maintained. Do not use in systems where the water is not recirculated.

**INTERMITTENT (SLUG DOSE) METHOD**  
**Initial Dose:** When the system is relatively clean, apply 2.0 to 4.0 lbs. of active ingredient of AQUICAR GA 25 Water Treatment Microbiocide per 1,000 gallons of water in the system. Repeat at 10-14 day intervals.  
**Subsequent Dose:** When microbial control is needed, apply 0.2 to 0.4 lbs. of active ingredient of AQUICAR GA 25 Water Treatment Microbiocide per 1,000 gallons of water in the system only. Only make repeat rate to clean before treatment begins.

**CONTINUOUS FEED METHOD**  
**Initial Dose:** When the system is relatively clean, apply 2.0 to 4.0 lbs. of active ingredient of AQUICAR GA 25 Water Treatment Microbiocide per 1,000 gallons of water in the system. Repeat at 10-14 day intervals.  
**Subsequent Dose:** Maintain flow rate constant by adding a continuous feed rate of 2.0 to 4.0 lbs. of active ingredient of AQUICAR GA 25 Water Treatment Microbiocide per 1,000 gallons of water in the system only. Only make repeat rate to clean before treatment begins.

**SERVICE WATER AND AUXILIARY SYSTEMS**  
 AQUICAR GA 25 Water Treatment Microbiocide should be used at the same application rate, and in the same manner as described above. Initial treatments should be given at a minimum rate to maintain the system.

**HEAT TRANSFER SYSTEMS**  
 (Superheated Condensate, Gas, Steam and Organic Vapor, Hot Water, Oil, and Steam, Air Washers, and Process and Air Washers)  
 AQUICAR GA 25 Water Treatment Microbiocide should be used at the same application rate, and in the same manner as described above. Repeat at 10-14 day intervals at a concentration of 1.0 to 2.0 lbs. of active ingredient per 1,000 gallons of water in the system.

**INDUSTRIAL WASH WATER SYSTEMS**  
 (Water, Organic, Water-based Sludge and Water-based Solids)  
 AQUICAR GA 25 Water Treatment Microbiocide should be used at the same application rate, and in the same manner as described above. Repeat at 10-14 day intervals at a concentration of 1.0 to 2.0 lbs. of active ingredient per 1,000 gallons of water in the system.

**PAPER MILLS AND PAPER MILL PROCESS WATER SYSTEMS**  
 AQUICAR GA 25 Water Treatment Microbiocide should be added to the paper making system at a point of application such as the beater, broke clean pump, or wet end tank or elsewhere in the line.  
**Initial Dose:** When the system is relatively clean, apply 1.0 to 2.0 lbs. of AQUICAR GA 25 Water Treatment Microbiocide per 100 to 200 gallons of water in the system. Repeat at 10-14 day intervals at a concentration of 0.2 to 0.4 lbs. of AQUICAR GA 25 Water Treatment Microbiocide per 100 to 200 gallons of water in the system.

**PIGMENTS AND FILLER SLURRIES FOR PAPER AND PAPERBOARD**  
 (For use in food and non-food contact pigments and filler slurries)  
 Use 0.2 to 0.4 lbs. of AQUICAR GA 25 Water Treatment Microbiocide per 1,000 to 2,000 lbs. of product to produce a concentration of 200 to 1,200 ppm of product based on slurry. Repeat at 10-14 day intervals.

**WATER BASED COATINGS**  
**NOTE:** For use in non-food contact coatings only.  
 Use 0.2 to 0.4 lbs. of AQUICAR GA 25 Water Treatment Microbiocide per 1,000 to 2,000 lbs. of product to produce a concentration of 200 to 1,200 ppm of product based on slurry. Repeat at 10-14 day intervals.

**WATER FLOODS**  
 AQUICAR GA 25 Water Treatment Microbiocide should be added to a water flood system at a point of application.

**Initial Treatment:** Verify the system is relatively clean, and apply 2.0 to 4.0 lbs. of active ingredient of AQUICAR GA 25 Water Treatment Microbiocide per 1,000 gallons of water in the system. Repeat at 10-14 day intervals.  
**Subsequent Dose:** When microbial control is needed, apply 0.2 to 0.4 lbs. of active ingredient of AQUICAR GA 25 Water Treatment Microbiocide per 1,000 gallons of water in the system only. Only make repeat rate to clean before treatment begins.

### DRILLING, COMPLETION, AND WORKOVER FLUIDS

AQUICAR GA 25 Water Treatment Microbiocide should be added to drilling fluids and completion fluids at a point of application.  
**Initial Treatment:** Apply 1.0 to 2.0 lbs. of AQUICAR GA 25 Water Treatment Microbiocide per 1,000 gallons of water in the system. Repeat at 10-14 day intervals.  
**Subsequent Dose:** When microbial control is needed, apply 0.2 to 0.4 lbs. of active ingredient of AQUICAR GA 25 Water Treatment Microbiocide per 1,000 gallons of water in the system only. Only make repeat rate to clean before treatment begins.

### TRUCKS/FLUIDS

AQUICAR GA 25 Water Treatment Microbiocide should be added to a truck fluid at a point of application.  
**Initial Treatment:** Apply 1.0 to 2.0 lbs. of AQUICAR GA 25 Water Treatment Microbiocide per 1,000 gallons of water in the system. Repeat at 10-14 day intervals.  
**Subsequent Dose:** When microbial control is needed, apply 0.2 to 0.4 lbs. of active ingredient of AQUICAR GA 25 Water Treatment Microbiocide per 1,000 gallons of water in the system only. Only make repeat rate to clean before treatment begins.

### GAS PRODUCTION AND TRANSMISSION PIPELINES AND SYSTEMS

AQUICAR GA 25 Water Treatment Microbiocide should be added to a gas production or transmission pipeline at a point of application. The application should be continuous or intermittent (see label for details).  
**Initial Treatment:** Apply 1.0 to 2.0 lbs. of AQUICAR GA 25 Water Treatment Microbiocide per 1,000 gallons of water in the system. Repeat at 10-14 day intervals.  
**Subsequent Dose:** When microbial control is needed, apply 0.2 to 0.4 lbs. of active ingredient of AQUICAR GA 25 Water Treatment Microbiocide per 1,000 gallons of water in the system only. Only make repeat rate to clean before treatment begins.

### GAS STORAGE TANKS AND SYSTEMS

AQUICAR GA 25 Water Treatment Microbiocide should be added to a gas storage tank at a point of application.  
**Initial Treatment:** Apply 1.0 to 2.0 lbs. of AQUICAR GA 25 Water Treatment Microbiocide per 1,000 gallons of water in the system. Repeat at 10-14 day intervals.  
**Subsequent Dose:** When microbial control is needed, apply 0.2 to 0.4 lbs. of active ingredient of AQUICAR GA 25 Water Treatment Microbiocide per 1,000 gallons of water in the system only. Only make repeat rate to clean before treatment begins.

### HYDROTREATING

Use 0.2 to 0.4 lbs. of AQUICAR GA 25 Water Treatment Microbiocide per 1,000 to 2,000 lbs. of product to produce a concentration of 200 to 1,200 ppm of product based on slurry. Repeat at 10-14 day intervals.

### PIPELINE PIGGING AND SCRAPING OPERATIONS

AQUICAR GA 25 Water Treatment Microbiocide is a pig cleaning agent following the pigging (scraper) when the water flow rate is constant and continuous. However, the scraper and a trailing pig. Scatter AQUICAR GA 25 Water Treatment Microbiocide to be added to produce a concentration of 0.2 to 0.4 lbs. of active ingredient of AQUICAR GA 25 Water Treatment Microbiocide per 1,000 gallons of water in the system.

IN CASE OF AN EMERGENCY endangering life or property involving this product, call collect (989) 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. 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 which have continuous recirculation.

**AQUCAR GA 25 Water Treatment Microbiocide should be added to a freshly prepared fluid depending on the severity of contamination.**

### DRILLING, COMPLETION, AND WORKOVER FLUIDS

**AQUCAR GA 25 Water Treatment Microbiocide should be added to a freshly prepared fluid depending on the severity of contamination.**

**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 AQUCAR GA 25 Water Treatment Microbiocide per 100 barrels of additional fluid.

**PACKING FLUIDS**  
 AQUCAR GA 25 Water Treatment Microbiocide should be added to a freshly prepared fluid depending on the severity of contamination.

**QA/QC PRODUCTION AND TRANSMISSION PIPELINES AND SYSTEMS**  
 AQUCAR GA 25 Water Treatment Microbiocide should be added to a gas production stream at a concentration of 100 to 2,000 ppm AQUCAR GA 25 Water Treatment Microbiocide per 100 barrels of fluid.

**HYDROLYSIS**  
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**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 or Plastic 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.



**The Dow Chemical Company**  
 Midland, Michigan 48674 U.S.A.  
 (989) 636-1400

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Net Contents: 5, 55 gallons or bulk

| CONTAINER SIZE<br>GALLONS | CONTAINER SIZE<br>55 GALLONS | CONTAINER SIZE<br>TOTE     |
|---------------------------|------------------------------|----------------------------|
| 44 POUNDS<br>NET WEIGHT   | 486 POUNDS<br>NET WEIGHT     | 2,316 POUNDS<br>NET WEIGHT |

(8) Samples, 5 gallon pails (less than full pail)

(H03A)  
 (P03B)

**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 AQUCAR GA 25 Water Treatment Microbiocide per 100 barrels of additional fluid.



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

180269-04/100018

IN CASE OF AN EMERGENCY endangering life or property involving this product, call collect (989) 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°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 TEFLO™ 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 ANY 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 Regional Office for guidance.  
**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

**WATER FLOODS**  
 AQUICAR GA 25 Water Treatment Microbicide should be added to a water flood system at a rate of 0.05 ppm.

**Label Statement:** See the product label for complete instructions. Do not use AQUICAR GA 25 Water Treatment Microbicide for use other than as labeled. Repeat and control as advised.  
 Subsequent to use, wear rubber boots and gloves, and do not use AQUICAR GA 25 Water Treatment Microbicide for use in a gallon AQUICAR GA 25 Water Treatment Microbicide per 1,000 gallons of water in the water works, or as directed on the label.

**The Dow Chemical Company**  
 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.

| CONTAINER SIZE | CONTAINER SIZE | CONTAINER SIZE |
|----------------|----------------|----------------|
| 5 GALLONS      | 55 GALLONS     | TOTE           |
| 44 POUNDS      | 486 POUNDS     | 2,376 POUNDS   |
| NET WEIGHT     | NET WEIGHT     | NET WEIGHT     |

Net Contents: 5, 55 gallons or bulk

**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



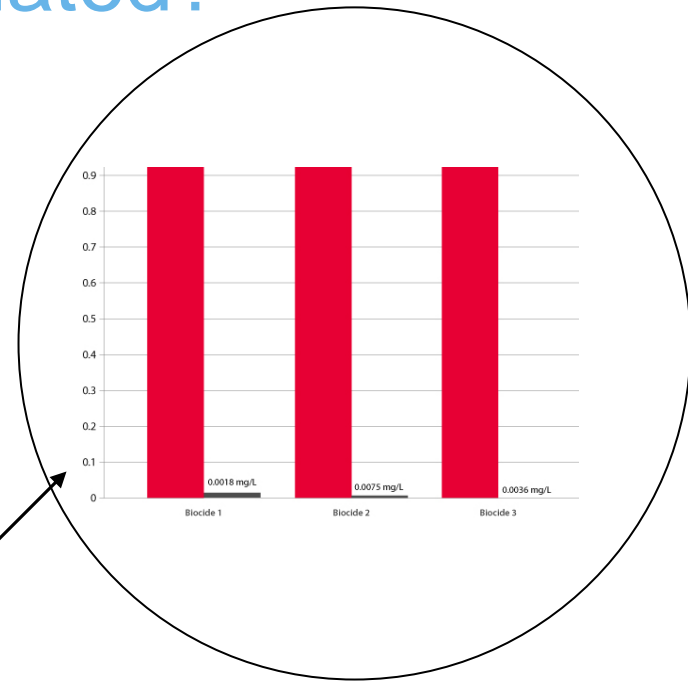
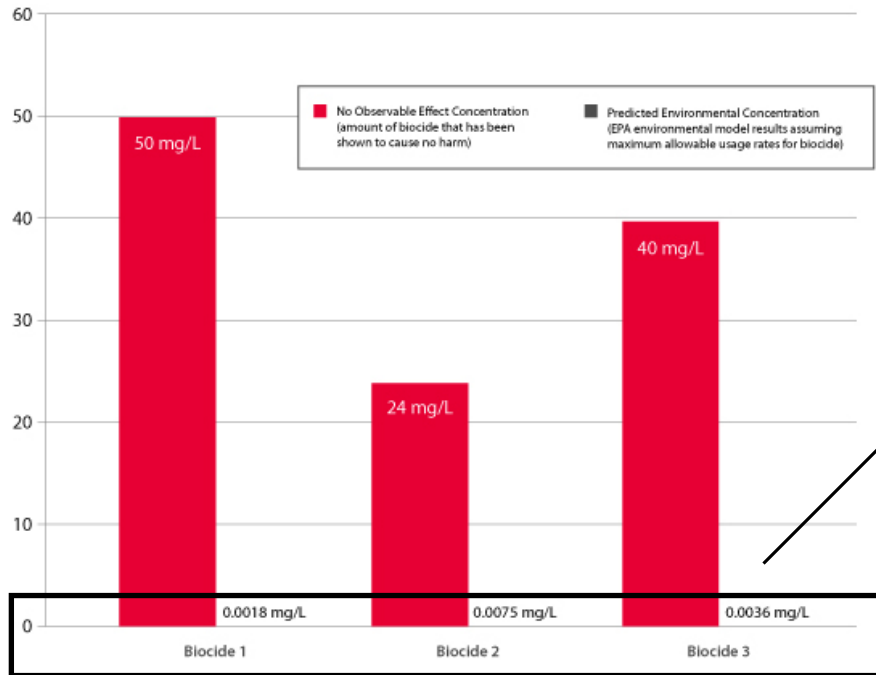


# How are biocides evaluated?

- 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!

