



Basic Pool & Spa Care

Module 3: Sanitizing and Oxidizing

Exceptional People. Proven Methods

Table of Contents

MODULE 3: SANITIZING AND OXIDIZING

<i>Objective</i>	4
<i>Purpose</i>	5
<i>Sanitizers</i>	
Objectives.....	6
Topic Introduction.....	6
Sanitizers.....	7
Chlorine- The Most Popular Sanitizer.....	7
Free Available Chlorine (FAC).....	7
Types of Chlorine.....	8
Unstabilized Chlorine Products.....	8
The Incompatibility Problem.....	8
<i>Stabilizer</i>	
Objectives.....	9
Topic Introduction.....	9
Stabilizer.....	10
When to Add Stabilizer.....	10
Stabilizer + Chlorine = Stabilized Chlorine.....	10
How Much is Too Much?.....	10
What's the Right Recommendation?.....	11
Stabilized Chlorine.....	11
Overview of BioGuard® Chlorine Sanitizers.....	12
<i>Chlorinators/ Chlorine Generation</i>	
Objectives.....	14
Topic Introduction.....	14
Chlorinators.....	15
Mineral Springs® Chlorine Generation.....	15
If FAC is too High.....	16
If FAC is too Low.....	16
<i>Chloramines</i>	
Objectives.....	17
Topic Introduction.....	17
Combined Chlorine = Chloramines.....	18
The Effects of Nitrogen.....	18
How Much is Too Much.....	19
Oxidize to Clean Up Chloramines.....	19
Breakpoint Chlorination – All or Nothing.....	19
How Often Do You Destroy the Chloramines?.....	19
Achieving Breakpoint.....	20
A Note About Breakpoint Chlorination.....	20
Weekly Shocking with Smart Shock™.....	20
Oxysheen® Breakpoint without Chlorine.....	21
So What If?.....	21
Chlorine Keys.....	21

Overview of BioGuard® Oxidizers.....	22
<i>BioGuard Chlorine Program Chemistry</i>	
Objectives.....	23
Topic Introduction.....	23
Why Choose a Program?.....	24
Once-A-Week 3-Step Program.....	24
3-Step Program.....	24
Optimize the Program.....	25
Mineral Springs®.....	25
Which Program is Ideal?.....	26
<i>Bromine</i>	
Objectives.....	28
Topic Introduction.....	28
Bromine.....	29
Bromine and the Sun.....	29
Brominators.....	29
Oxidize to Eliminate Undesirable Compounds.....	30
BioGuard Bromine Sanitizers.....	30
Bromine Keys.....	30
<i>Biguanide</i>	
Objectives.....	31
Topic Introduction.....	31
Biguanide- the Non-Chlorine, Non-Halogen Sanitizer.....	32
How Biguanide Chemistry Works.....	32
Filter Cleaning is Essential.....	32
A Word About Cleaning.....	33
The Ideal Biguanide Pool.....	33
Oxidizing a Biguanide Pool.....	33
Assist® - The Answer to the Slime and Mold Problem....	34
Biguanide Keys.....	35
SoftSwim®- The BioGuard® Biguanide Program	35

Module 3: Sanitizing and Oxidizing

This module should take approximately 6.5 hours to complete.

Objectives

3.0 Given a scenario, describe sanitizing and oxidizing and the BioGuard® products available and their uses according to BioGuard standards.

- 3a Define HOCL.
- 3b Identify accurate Free Available Chlorine maintenance levels.
- 3c Specify the half-life of unstabilized chlorine.
- 3d Identify BioGuard unstabilized chlorine.
- 3e List other names of stabilizer.
- 3f Define maintenance levels of stabilizer in a residential pool.
- 3g Specify the BioGuard products that contain stabilized chlorine.
- 3h Recognize characteristics of BioGuard sanitizers.
- 3i Determine chlorine recommendations for new pool customers.
- 3j Define chloramines.
- 3k Define breakpoint chlorination.
- 3l Identify the primary oxidizers contained in BioGuard® products.
- 3m Identify the proper chloramines level.
- 3n Re-entry after breakpoint chlorination.
- 3o List benefits of using Smart Shock™ over Burn Out® Extreme™.
- 3p Specify when to recommend Oxysheen.
- 3q Recognize the importance of program chemistry.
- 3r Define the BioGuard pool maintenance programs.
- 3s Determine ideal program for customers.
- 3t Identify characteristics and usages of bromine.
- 3u Identify characteristics and advantages of biguanide.
- 3v Explain the importance of maintaining peroxide levels and filter cleaning in a biguanide pool.
- 3w Identify key ingredients in and maintenance levels of SoftSwim® Clarifier C.

Purpose

This module describes sanitizers, stabilizers, chlorinators, bromine, and biguanide. The importance of these substances and their maintenance level is explained. This module describes the BioGuard® products in each of these categories and their recommended uses.

Sanitizers

This topic should take you approximately 45 minutes to complete.

Objectives

- Define HOCL.
- Identify accurate Free Available Chlorine maintenance levels.
- Specify the half-life of unstabilized chlorine.
- Identify BioGuard® unstabilized chlorine.

Topic Introduction

This topic describes:

1. Sanitizers
2. Chlorine – The Most Popular Sanitizer
3. Free Available Chlorine (FAC)
4. Types of Chlorine
5. Unstabilized Chlorine Products
6. The Incompatibility Problem

Sanitizers

Sanitizers are added to the water to control the growth of *pathogenic* (disease causing) bacteria. BioGuard® offers two “*stand-alone*” options proven to accomplish this task. Both are represented in products that BioGuard uses to sanitize pools:

- **Halogens** – A naturally occurring family of electronegative elements that is toxic to microorganisms by interrupting the enzymatic reactions of bacterial and algae. Chlorine and bromine are also powerful oxidizers.
- **Biguanide** – A synthetic polymer compound that readily attracts bacteria, by disrupting the cellular activity. Biguanide polymers are not oxidizers.

Before we discuss these two types of sanitizers it is important to understand why we called these two “*stand-alone*” sanitizers. *Stand-alone* means that the *biocidal activity* (the verifiable mechanism of chemical reactions that, by whatever means, serves to control the growth of living biological organisms) of their chemistry will, by itself, provide control over the growth of bacteria. As such, the Environmental Protection Agency recognizes them “as effective methods for use in pool and spa water without the need for additional support chemistry.” Chlorine is, by far, the most commonly used pool sanitizer.

Chlorine – The Most Popular Sanitizer

Over 90% of all pools (commercial and residential) in operation today use some form of chlorine as a sanitizer. That’s because it’s highly effective. When chlorine (Cl) is added to water (HOH – a.k.a. H₂O), it forms Hypochlorous Acid (HOCl), a very aggressive and efficient sanitizer.



When we test for this compound in pool water, we refer to it as Free Available Chlorine (FAC), meaning it is free and available to kill bacteria.

Free Available Chlorine (FAC)

HOCl (FAC) kills bacteria very effectively. First it eats through the cell wall by disrupting the action of the enzymes. Then it consumes the inside of the cell via oxidation. Of course, you have to maintain enough FAC to control the amount of bacteria in a given pool. But all pools need to keep FAC within the acceptable range.



So what is a ppm?

Parts per million is a unit of measurement used in measuring chemical application. It indicates the amount, by weight, of a chemical in relation to one million parts, by weight, of water.

Types of Chlorine

Two types of chlorine are available; they are categorized based on their vulnerability to the ultraviolet (UV) rays of the sun

- Unstabilized = Inorganic = lost quickly to the sun's UV rays.
- Stabilized = Organic = not lost quickly to the sun's UV rays.

Unstabilized Chlorine Products

Any chlorine introduced into a pool forms hypochlorous acid (HOCl) to kill bacteria. However, HOCl is vulnerable to the ultraviolet (UV) rays of the sun. For every 35 minutes the pool is exposed to the sun, the water will lose half of HOCl present. So even if you start with a FAC (Free Available Chlorine) level of three ppm, which is the top of the ideal range, the unstabilized HOCl would be .75 ppm, which is below the recommended range, in just 70 minutes from the effect of the sunlight alone.

As a result, frequent applications of unstabilized chlorine are necessary in order to maintain FAC in the recommended range. Customers who choose unstabilized chlorine as their sanitizer must check and adjust FAC at least once a day, every day. Typically, the reason a customer chooses unstabilized chlorine isn't based on a good understanding of the different types of chlorine. Many pool owners think all chlorine is the same. Since unstabilized chlorine is generally much less expensive (per pound) than the stabilized forms, an uneducated choice is made for Calcium Hypochlorite (granular in a drum) or Sodium Hypochlorite (bleach in a bottle).

It's even worse when pool professionals assume that all chlorine is the same. Many pool industry 'veterans' unwittingly contribute to the ignorance of the pool-owning public by not educating these customers on the differences. The result of this bad choice leads to problems associated with low, or no, Free Available Chlorine in the water (cloudy water, algae growth). Compounding the situation are these pool owners who discourage potential pool owners by telling them of their bad experiences, and how much problem it is to maintain a pool.

The Incompatibility Problem

A pool owner who thinks all chlorine is the same is a threat to the sale of another pool, but he is also a threat to himself.

By their chemical nature, organic chlorine and inorganic chlorine are incompatible. Additionally, some forms of unstabilized chlorine (Calcium Hypochlorite, for example) are extremely reactive. They cause fire or explosion if mixed with any form of stabilized chlorine or with just about any type of oil or liquid.

Every year many accidents are attributed to the fact that users do not know any better or they don't appreciate the consequences of mixing different chemicals together. You do know better, and now you know the possible consequences.

Stabilizers and Stabilized Chlorine

This topic should take you approximately 45 minutes to complete.

Objectives

- List the other names of stabilizer
- Define the maintenance levels of stabilizer in a residential pool
- Specify the BioGuard® products that contain stabilized chlorine

Topic Introduction

This topic describes:

1. Stabilizer
2. When to Add Stabilizer
3. Stabilizer + Chlorine = Stabilized Chlorine
4. How Much is Too Much
5. What's the Right Recommendation
6. Stabilized Chlorine
7. Overview of BioGuard® Chlorine Sanitizers

Stabilizer

Stabilizer is an organic compound that protects chlorine from the sun. Its chemical name is trihydroxy-s-triazinetrione. It is also known as Cyanuric Acid (CYA) and is sometimes referred to as “conditioner.”

When a HOCl molecule is attached to a stabilizer molecule, it is safe from the UV rays of the sun. However, while attached to the stabilizer, the HOCl does not kill bacteria. So HOCl only works when it’s moving between stabilizer molecules. The ideal level of CYA provides plenty of opportunities for protection of the HOCl from UV rays while leaving enough room for the HOCl to move efficiently, encountering and killing bacteria.

Minimum CYA Level: 30 - 40 ppm

Acceptable CYA Range: 30 - 200 ppm

When to Add Stabilizer

Customers using unstabilized chlorine to kill bacteria can extend the life expectancy and efficiency of the FAC by adding **Stabilizer 100®** to outdoor pools to establish a cyanuric acid level. Initially, you should add enough Stabilizer 100 to achieve 40 ppm and maintain 30-40 ppm at all times. A pool being maintained on stabilized chlorine will constantly have a replenishing source of stabilizer being fed to the pool as the stabilized product is dissolved into the water.



Stabilizer + Chlorine = Stabilized Chlorine

Rather than add a separate stabilizer, most pool owners prefer the convenience of a sanitizer that contains both chlorine and stabilizer. One of the best stabilized chlorine products for sanitizing is trichloro. Its strong formula dissolves slowly and completely. This makes it perfect to compress into sticks or tablets. Dichloro is not quite as strong and dissolves faster. Because it dissolves so fast, when it’s used as a primary sanitizer, it is usually hand fed into a pool. More often, dichloro is used to provide a quick stabilized chlorine boost to a pool with heavy bather load or to oxidize waste or kill algae. You’ll find more information on different types of stabilized chlorine on the following pages.

How Much is Too Much?

A common myth in the pool industry claims that too much Cyanuric Acid in pool water “locks-up” the Free Available Chlorine. Chemically, this is not accurate. The FAC kills microorganisms with CYA levels of up to 500 ppm. However, too much CYA could add to

the accumulation of other dissolved solids in the water. With high TDS (Total Dissolved Solids) the FAC does not have ‘room’ to move around these dissolved obstacles to get to the bacteria.

What’s the Right Recommendation?

So what is your responsibility? In a residential pool, try to assist the pool owner in managing the CYA level within the recommended range of 30 - 200 ppm. If you test and measure the CYA level in excess of 200 ppm, ask the pool owner, **“How does the water look?”** If the water looks good and no other problems are evident, don’t worry about it. Pools with a cartridge or D.E. filter may notice CYA levels increasing at a more rapid rate than a pool operated with a sand filter. This is due to the fact that backwashing a sand filter removes water from the pool and subsequent refilling with fresh water dilutes the CYA concentration.

CYA does have an affect on the measured (tested) level of Total Alkalinity. In short, a percentage of what is being tested, as total alkalinity is actually CYA. ALEX automatically takes this into consideration when the tests are entered.

Stabilized Chlorine

Though introduced to the pool industry nearly 20 years ago, stabilized chlorine is new to many people. Stabilized chlorine offers pool owners a definite advantage over its unstabilized counterparts.

There are two types of stabilized chlorine: Dichloro-s-triazinetriene (dichlor) and Trichloro-s-triazinetriene (trichlor). The following table helps organize the characteristics of BioGuard stabilized chlorinating products.

TYPE	FORM	ADVANTAGES	DISADVANTAGES	APPLY BY	BIOGUARD PRODUCTS
Dichloro-S-Triazinetrione	Granular	Totally soluble Good at killing algae in all types of pools Variety of uses Near neutral pH (6.0)	Difficult to put in a tablet or stick form.	Hand Feed	Spot Kill® (algicide) Super Soluble (sanitizer) Smart Shock™ (blended oxidizer) Easy Shock and Swim (blended oxidizer)
Trichloro-S-Triazinetrione	Granular Tablets Sticks	Very concentrated Slow dissolving Totally soluble All-in-one product Ideal for killing black algae in white plaster pools	Slow dissolving Low pH (2.9)	Skimmers Automatic chlorinators Floaters, chlorinator Hand Feed	Smart Sticks® Stingy Sticks® 1" & 3" Tablets Everyday Chlorinating Granules™ (blended sanitizer and oxidizer) Super 90 (sanitizer) Spot Kill WP® (algicide)

Overview of BioGuard® Chlorine Sanitizers

BioGuard offers a variety of sanitizers in various forms. **CLC²®** is an unstabilized calcium hypochlorite sanitizer. **Lithium Hypochlorite** is a similar unstabilized sanitizer that will not raise the calcium hardness level of the water.

Stabilized sanitizers come in three main forms: sticks, tablets and granules. **Smart Sticks®** are trichlor sticks with Smart Guard® erosion control to maximize effectiveness. Smart Sticks are applied through the skimmer. **Stingy Sticks®** are also trichlor sticks that are applied through an automatic chlorinator or chemical feeder. **1" Tablets** and **3" Tablets** are trichlor tablets than can be applied through a floater, a feeder, or through the skimmer.

Granular stabilized sanitizers include **Super 90** a trichlor sanitizer intended for use in white plaster pools. **Super Soluble** is a granular dichlor sanitizer that is suitable for all pool surfaces. **Everyday Chlorinating Granules**TM is a blended sanitizer/oxidizer that uses trichlor as the active sanitizer.

Chlorinators/Chlorine Generation

This topic should take you approximately 45 minutes to complete.

Objectives

- Recognize characteristics of BioGuard® sanitizers
- Determine chlorine recommendations for new pool customers.

Topic Introduction

This topic describes

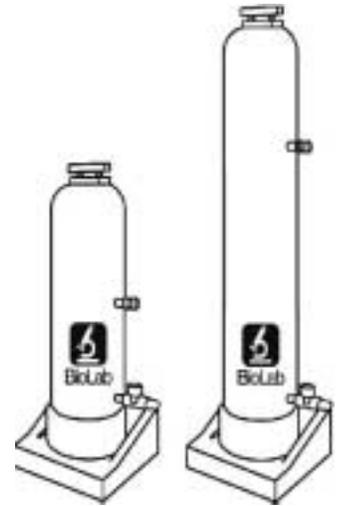
1. Chlorinators
2. Mineral Springs®
3. If FAC is too High
4. If FAC is too Low

Chlorinators

Typically, stabilized chlorine is released into a pool through a chlorinator. All chlorinators allow water to flow over the compressed sticks or tablets. The water gradually dissolves the trichloro granules by eroding the stick or tablet. That's why chlorinators are also known as erosion feeders.

There are basically four kinds of chlorinators:

- **The Skimmer** – Many pool owners use the skimmer built into the pool as the chlorinator. Simply drop the sticks or tablets into the skimmer basket and, as long as the pump is running chlorine is fed into the pool.
- **In-line Automatic Chlorinator**- A chlorinating chamber plumbed directly into the return line of the pool system.
- **Off-line Automatic Chlorinator**-A separate component set off to the side of the system plumbing and attached by small connecting feeder hoses.
- **Floater** – A canister for chlorine sticks or tablets that literally floats around in the pool releasing chlorine.



Chlorine Generation

The BioGuard® Mineral Springs® chlorine generation system is an alternate form of automatic chlorination in pools. Mineral Springs automatically sanitize your pool by converting minerals into free chlorine that kills bacteria and algae in the pool, through a process called electrolysis. Essential elements pass through the electrolytic cell to automatically produce sanitizer at a level that the consumer controls. The Mineral Springs system eliminates the need to purchase and handle chlorinating chemicals. It's the benefit of chlorination without the hassle of adding chlorinating chemicals. For more details, refer to the Mineral Springs section of Program Chemistry.



If FAC Is Too High...

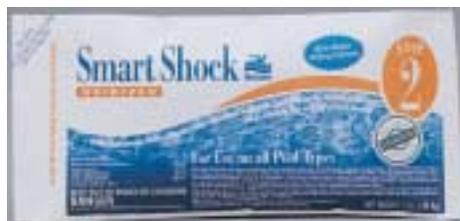
Excess chlorine can be removed with the addition of BioGuard® Chem Out®. For every 10,000 gallons of pool water, two ounces of Chem Out will neutralize 1 ppm of Free Available Chlorine. Partially draining existing water and adding fresh water can also help dilute high Free Available Chlorine levels.



If FAC Is Too Low...



BioGuard® Super Soluble and Everyday Chlorinating Granules™ are good products to add to a pool for a quick increase in chlorine if needed. Increasing the amount of Stingy Sticks® or Smart Sticks® that are being used will also help raise the chlorine level. In the heat of the season, it's a good idea to add more product and run the pump longer to ensure adequate dissolution. Shocking with Smart Shock® can also help raise the FAC level.



Chloramines

This topic should take you approximately 90 minutes to complete.

Objectives

- Define chloramines.
- Define breakpoint chlorination.
- Identify the primary oxidizers contained in BioGuard products.
- Identify the proper chloramines level.
- Re-entry after breakpoint chlorination.
- List benefits of using BioGuard® Smart Shock™ over BurnOut® Extreme™.
- Specify when to use Oxysheen to customers.

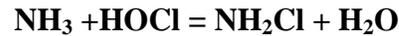
Topic Introduction

This topic describes

1. Combined Chlorine = Chloramines
2. The Effects of Nitrogen
3. How Much is Too Much?
4. Oxidize to Clean up Chloramines
5. Breakpoint Chlorination – All or Nothing
6. How Often Do You Destroy Chloramines?
7. Achieving Breakpoint
8. A Note About Breakpoint Chlorination
9. Weekly Shocking with Smart Shock™
10. Oxysheen Breakpoint without Chlorine
11. So What If...
12. Chlorine Keys
13. Overview of BioGuard® Oxidizers

Combined Chlorine...Chloramines

When nitrogenous compounds enter a pool, the chlorine is attracted to them. When these nitrogenous compounds and chlorine molecules come in contact, they form a new compound, called a *chloramine* (NH_2Cl), or combined chlorine.



The Effects of Nitrogen

Nitrogen is a colorless, odorless gas. It is a common element and part of the chemical make-up of:

- Urine
- Perspiration
- Cosmetics/Lotions
- Rain
- Fertilizer

When these nitrogenous compounds and HOCl combine, chloramines (NH_2Cl & $NHCl_2$) are formed. Chloramines are also called *combined chlorine*. Since the chlorine is combined with the nitrogen, it is no longer free and available to kill bacteria as effectively as *Free Available Chlorine*. The chlorine in these chloramines no longer functions as an effective sanitizer and as the chloramines build up, several other problems can occur.

- The water smells bad, giving off an obnoxious chlorine-like smell.
- The water irritates the mucous membranes of the nose and eyes.
- The water is cloudy or dull looking.



How Much is Too Much?

It doesn't take many chloramines to make water cloudy and irritating. You should always keep this combined chlorine as low as possible.

Maximum tolerable combined chlorine level --- BELOW .2 ppm

Oxidize to Clean Up Chloramines

To rid a pool of chloramines, you must add sufficient amount of oxidizer to break the chlorine and nitrogen apart. This is called *breakpoint*. There are two ways to reach breakpoint and both involve oxidation.

Breakpoint Chlorination- All or Nothing

Since chlorine is already used in many pools, the process of breakpoint chlorination is often used to achieve breakpoint. However, the Free Available Chlorine (expressed as ppm) must exceed the Combined Chlorine (expressed as ppm) by a factor of 10 to achieve breakpoint.

10 ppm HOCl (FAC): 1 ppm NH₂Cl (CC)

The breakpoint ratio has to be achieved to have any effect at all. If you do not reach the 10:1 ratio, you have only added more FAC. You have not eliminated the chloramines and, if excess nitrogen is available in the water, may have actually created **more** chloramines.

How Often do you Destroy the Chloramines?

Breakpoint needs to be performed regularly to control chloramines. If there's an excess of nitrogen-containing contaminants in the water (e.g. ammonia, urine, etc.) the nitrogen will seek out the new chlorine (being added to provide breakpoint) and form more new chloramines. Of course, that aggravates the problem instead of solving it. So you want to oxidize the water often enough so that this never becomes an issue. If a water test reveals zero Free Available Chlorine in the water and any level of Combined Chlorine, that is a tell-tale sign that there could be excess nitrogen in the water.

Beware!

- Pools should remain uncovered for eight hours after shocking.
- Provide adequate air circulation on indoor pools.
- Provide adequate time for breakpoint reactions to occur.

It's best to perform breakpoint on a schedule that controls the build-up of chloramines. The frequency is also affected by the amount of nitrogen being introduced. Some criteria affecting this frequency are: the number, age and type of swimmers, the amount of rain and

ground water run-off, the geographic location of the pool, and exposure to fertilizer applications.

Achieving Breakpoint

To clarify the water and break down chloramines, perspiration, suntan & body oils, and urine, you need the right products. As a BioGuard dealer, you have four:

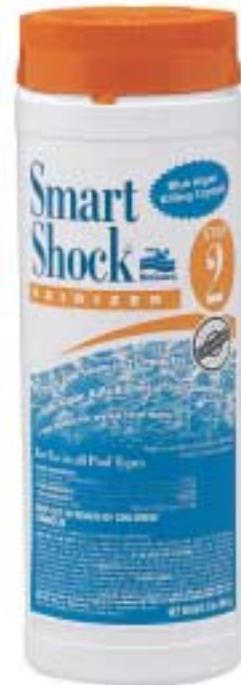
- **Smart Shock™** -A new patented blend of chlorine, clarifiers, buffers and oxidizers.
- **Burn Out® Extreme™** – A specially packaged formulation of Calcium Hypochlorite, this product is will not contribute to the CYA level.
- **Burn Out® 35** – Formulated from Lithium Hypochlorite, this product is ideal for pools with bleachable surfaces like vinyl. It does not have to be pre-dissolved.
- **Oxysheen®** - The use of this Potassium Monopersulfate product provides a non-chlorine alternative to achieve breakpoint.

A Note About Breakpoint Chlorination

Breakpoint chlorination with Burn Out Extreme and Burn Out 35 adds a substantial amount of FAC to the water, and reentry to the water should be postponed until the FAC level drops back to 3 ppm or less. Depending on the level of FAC you needed to reach breakpoint, it may take eight hours or more before reentry is advised.

Weekly Shocking with Smart Shock™

Smart Shock makes it easier to remove chloramines and maintain good water quality on a regular basis. This special blend of oxidizers and clarifiers is formulated to add every week. The weekly application provides a convenient method for the constant removal of chloramines and contaminants such as urine, perspiration, suntan & body oils. In addition, Smart Shock introduces flocculating and buffering agents to provide clearer, more pH balanced pool water. The enhanced, synergistic oxidation characteristics of Smart Shock achieve the desired shocking results without measurably increasing free available chlorine; therefore, quick swimmer re-entry is permissible, usually in as soon as fifteen minutes.



Oxysheen® Breakpoint without Chlorine (Potassium Monopersulfate)

Chlorine is not the only oxidizer that destroys chloramines. Oxysheen destroys chloramines. Any potassium monopersulfate that's added will eliminate as many chloramines as it can. Though breakpoint IS occurring, it IS NOT an all or nothing reaction. This treatment is a good choice when the pool is indoors since high levels of chlorine are not introduced to the water.

So What If...

The Combined Chlorine is too low ... (below .2 ppm) Be happy! This is the kind of low reading you want. The water looks good, smells good, and is properly sanitized (if FAC is between 1 - 3 ppm).

The Combined Chlorine is too high ... (above .2 ppm) The water will look hazy. It will irritate the eyes and nose, and the sanitizer will be less effective. It's time to provide a breakpoint solution to the water.

- Use **Smart Shock™** weekly to destroy normal accumulation of Chloramines and provide sparkling clear water with minimal "down time."
- Use **Burn Out® Extreme™**, **Burn Out® 35** or **Oxysheen** if combined chlorine is higher than .5 ppm apply at a rate to provide breakpoint chlorination. (10:1 ratio of FAC: CC)

Chlorine Keys

- When any form of chlorine (Cl) is added to water (HOH), it forms Hypochlorous Acid (HOCl).
- HOCl is also known as Free Available Chlorine (FAC).
- HOCl/FAC is highly effective at killing bacteria and algae and sanitizing the water.
- An ideal level of FAC is 1 - 3 ppm.
- Cyanuric Acid (a.k.a. CYA, Stabilizer or Conditioner) protects HOCl/FAC from being lost to the UV rays of the sun.
- Noticeable symptoms of excessive chloramines include, eye irritation, obnoxious chlorine-like smell, and dull looking water.
- Breakpoint Chlorination is achieved when the ratio of FAC to Combined Chlorine is at least 10:1. If this ratio is not met then NO CHLORAMINES ARE REMOVED.
- Breakpoint Chlorination also oxidizes body oils, perspiration, urine, and suntan oil.

- Oxysheen® can eliminate a small amount of Chloramines with a small amount of product. An all or nothing reaction is NOT REQUIRED WITH OXYSHEEN.

Overview of BioGuard® Oxidizers

BioGuard® Product	Advantages	Disadvantages
Burn Out® Extreme™ Calcium Hypochlorite	Breakpoint removes all chloramines Oxidizes wastes Kills algae	Super doses required (10:1 ratio) Highly reactive, unstable Must wait until FAC residual level drops below 3 ppm to enter pool
Burn Out® 35 Lithium Hypochlorite	Breakpoint removes all chloramines Oxidizes other wastes Kills algae May be used safely in vinyl pools	Super doses required (10:1 ratio must be achieved) Must wait until FAC residual level drops below 3 ppm to enter pool
Oxysheen® Potassium Monopersulfate	Removes some or all chloramines Is not an all or nothing reaction Swim in 15 minutes Reduces NH ₂ Cl enough to use Breakpoint Chlorination.	Does not necessarily remove all chloramines Does not super oxidize other wastes in water Does not kill algae Does not rechlorinate stabilizer
Smart Shock™ Easy Shock and Swim™	Removes chloramines Oxidizes perspiration, body oils, urine and suntan oils Swim quickly after application (must wait until FAC residual level drops below 3 PPM to enter pool) Clarifies water and buffers against pH change	Not to be used if combined chlorine exceeds .5 ppm.

BioGuard® Chlorine Program Chemistry

This topic should take you approximately 45 minutes to complete.

Objectives

- Recognize the importance of program chemistry
- Define the BioGuard® pool maintenance programs
- Determine ideal program for customers

Topic Introduction

This topic describes:

1. Why Choose a Program?
2. Once-A-Week 3-Step Program
3. 3-Step Program
4. Optimize the Program
5. Mineral Springs®
6. Which Program is Ideal?

Why Choose a Program?

BioGuard® offers a variety of pool care programs designed to make pool care easy and trouble-free for pool owners. All programs include chemicals for sanitation, oxidation, and algae prevention. Each program is divided into easy-to-understand steps to take the guesswork out of pool maintenance.

The Once-A-Week 3-Step Program

This is our most convenient and flexible program. Follow it and it will just take minutes each week to keep pool water crystal clear and brilliant. Just 3 quick steps and you're done! BioGuard's Once-a-Week 3-Step Program is best suited for aboveground and in-ground pools with the following characteristics:

- Up to 25,000 gallons in size
- The pump circulates 10 to 12 hours a day
- Good water flow through the skimmer, with adequate skimmer basket area
- Any surface type



STEP 1: Keep pool water sanitized with BioGuard Smart Sticks®

STEP 2: Keep pool water clear with BioGuard Smart Shock™

STEP 3: Keep algae out with BioGuard Back-Up®

The 3-Step Program

The BioGuard 3-Step Program is ideal for pools of any size or surface with the following characteristics:



- Good water flow through skimmers (or a chlorinator if installed)
- Pump circulates eight hours or more per day
- Consistently heavy usage of the pool
- This program is another easy way to keep pools sparkling clear in 3 simple steps.

STEP 1: Keep pool water sanitized with BioGuard® Stingy Sticks®

STEP 2: Restore water sparkle with Burn Out® Extreme™ or Burn Out 35

STEP 3: Prevent algae growth with Back-Up® or Algae All 60

Optimize The Program!

No matter what BioGuard 3-Step Program your customer chooses, adding Optimizer® Plus™ enhances it. The customer will see and feel the difference Optimizer Plus makes. This all-around terrific product suppresses algae, stabilizes pH, and softens pool water.



Mineral Springs®

Mineral Springs is a chlorine program can be maintained with a bare minimum of time – just a few minutes a week. This system is designed to be extremely easy and convenient. Install the Mineral Springs unit according to the installation instructions provided. Add the Mineral Springs Beginnings® directly to the pool, no pre-dissolving necessary (temporary clouding will occur, but will clear within 48 hours with proper filtration). Add Renewal® once a week, broadcasting over the pool.

The Mineral Springs components produce a sanitizer residual that brings Beginnings® and Renewal® together for pool water that's crystal clear, and non-irritating to eyes, skin and hair. Mineral Springs automatically sanitizes your pool by converting the minerals into free chlorine that kills bacteria and algae in the pool.

There are three above ground/small pool models and two in-ground models. Some of their features include:

- Sanitizer adjustment dial to regulate the electrolytic generation of sanitizer.



- Sanitizer Boost button when pressed will produce sanitizer for 24 hours while pump is operating.
- Self-cleaning mechanism to help avoid the build up of scale.
- Low mineral shut-off to protect the cell if mineral residual drops below the recommended level.
- UL Approved

Mineral Springs Beginnings®

This essential component adds stable minerals to the water and creates a mineral water bathing environment. You'll notice the difference in the water immediately. The operation of the system requires these minerals to be present in the pool water. One bag per 1000 gallons of pool water is added at start-up or as needed during spring opening to obtain a 3000 ppm residual.

Mineral Springs Beginnings is a proprietary blend of elements, which contain:

- Salts for generation of the sanitizer
- Boron salts for softening the water
- pH Balancers/adjusters
- Stabilizers to prevent degradation from sunlight



Mineral Springs Renewal®

This essential product is added weekly at a rate of 1 bag per 20,000 gallons to replenish mineral levels. Like Beginnings, it also is a proprietary blend of elements. Renewal contains:



- Salts for generation of the sanitizer
- Boron salts for softening the water
- pH Balancers/adjusters to offset pH drift
- Chelants and scale inhibitors to prolong the life span of the cell and aid in efficient production of chlorine
- A filter aid and clarifier to maintain crystal, clear water

Which Program is Ideal?

Helping customers choose a program that is ideal for them is one of the keys to success with program chemistry. A few of the things to consider when choosing the ideal programs include:

- Time available to spend on the pool
- Frequency of chemical additions
- Convenience

- Environment
- Swimming patterns
- Cost

Discuss the options with customers and help them choose a program based on what is important to them when maintaining the pool.

Bromine

This topic should take you approximately 45 minutes to complete.

Objectives

- Identify characteristics and uses of bromine.

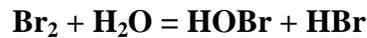
Topic Introduction

This topic describes

1. Bromine
2. Bromine and the Sun
3. Brominators
4. Oxidize to Eliminate Undesirable Compounds
5. BioGuard® Bromine Sanitizers
6. Bromine Keys

Bromine

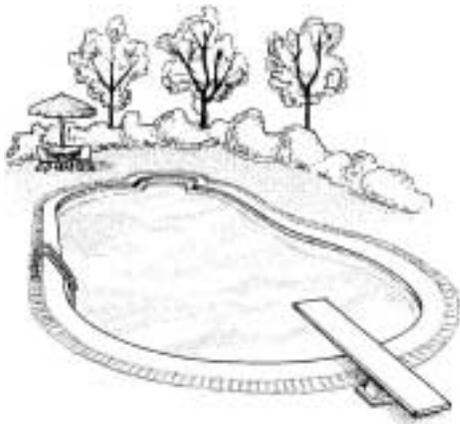
Although chlorine is the most popular sanitizer, it is not the only halogen. Another halogen, bromine, is also an effective sanitizer. Bromine is mined as a salt. Bromides themselves (like chlorides) do not kill anything. Bromides must be converted into bromine and the bromine combined with water to form the killing agent Hypobromous Acid (HOBr).



Once activated, HOBr attacks and kills bacteria and algae. Bromine is actually more effective than chlorine at killing some kinds of algae. Bromine also stays effective in a wider pH range than chlorine.



Bromine and the Sun



Bromine would be the perfect sanitizer except for the fact that it is unstabilized. As a result, there is no protection against the UV rays of the sun and bromine suffers a similar fate as unstabilized chlorine. However, it is ideal for use in indoor pools and spas.

Ideal Bromine Levels

3.0 to 6.0 ppm Commercial Pools

2.0 to 4.0 ppm Residential Pools (tablets)

Brominators

Bromine dissolves slower than chlorine; so therefore, brominators are designed differently than chlorinators. Brominators allow more water to wash over the bromine tablets so enough of the bromine can be dissolved to form HOBr.

Sizing a brominator is very important. Since HOBr is unstabilized, the brominator must dispense enough dissolved product to compensate for dissipation by the sun, bather loads, and other outside contaminating sources.

BioLab® manufactures a complete line of brominators for pools ranging in size from 10,000 to nearly 500,000 gallons.

Oxidize to Eliminate Undesirable Compounds

Bromamines are typically not a problem, and breakpoint oxidation is not needed to remove them. However, you still need to oxidize bromine systems to remove perspiration, body oil and urine. This is especially important in spas since the effects of the bather load are magnified. Oxidation can also regenerate the bromides back into bromine, which then forms the active species... hypobromous acid.

BioGuard® Bromine Sanitizers



BioGuard only offers one type of bromine sanitizer for pools, **Brominating Tablets**. These tablets are fed into the pool through a soaker-type chemical feeder to establish a bromine residual

Bromine Keys

- When bromine (Br_2) is added to water (H_2O) it forms Hypobromous Acid (HOBr).
- HOBr kills bacteria and algae in a wider pH range.
- Bromine cannot be stabilized against the UV rays of the sun.
- When nitrogen compounds come in contact with bromine, bromamines are formed.
- Oxidation removes perspiration, urine and body oils and reactivates the HOBr .
- Bromide regeneration to HOBr is a big advantage for the use of bromine.

Biguanide

This topic should take you approximately 60 minutes to complete.

Objectives

- Identify characteristics and uses of biguanide.
- Explain importance of maintaining the hydrogen peroxide level and filter cleaning in a biguanide pool.
- Identify key ingredients in and maintenance levels of *SoftSwim*® Clarifier C.

Topic Introduction

This topic describes

1. Biguanide – the Non-Chlorine, Non-Halogen Sanitizer
2. How Biguanide Chemistry Works
3. Filter Cleaning is Essential
4. A Word about Cleaning
5. The Ideal Biguanide Pool
6. Oxidizing a Biguanide Pool
7. Assist®- The Answer to the Slime and Mold Problem
8. Biguanide Keys
9. SoftSwim – The BioGuard Biguanide Program

Biguanide – the Non-Chlorine, Non-Halogen Sanitizer

Biguanide is a man-made, polymeric compound: Polyhexamethylene Biguanide Hydrochloride. It's known as **PHMB** for short.

PHMB is an effective bactericide and algistat. It's positioned as non-chlorine rather than chlorine-free because it is neither better than nor worse than chlorine. It's simply different.

There are a number of reasons why pool owners prefer a biguanide product:

- Liquid products are easy to use.
- Its polymeric chemistry polishes water, leaving it sparkling.
- The water feels smooth and gentle to bathers.
- The chemistry is gentle to pool surfaces, including vinyl.
- It's applied less frequently than many chlorine products.

How Biguanide Chemistry Works

A PHMB molecule looks very different from a chlorine molecule. Its microscopic shape is long, thin, and slightly twisted. Rather than seeking out and killing bacteria, PHMB attracts bacteria to it.

IDEAL BIGUANIDE LEVEL: 30 - 50 ppm

Since biguanide is not added often, it's easy for pool owners to forget or skip treatments. If the PHMB levels drop below 30 ppm, bacteria are not controlled adequately. It's very important to test the water weekly and add biguanide every other week or more often, if needed. It's also important to regularly maintain the pool especially the filter.

Filter Cleaning is Essential

The PHMB molecule is much larger than a chlorine molecule. Once it attracts all the debris and dead microorganisms, it gets even larger. These large particles are easily filtered out. That's good news and bad news.

- The good news is, since PHMB attracts dust, dirt and other inorganic debris, the water is clarified at the same time it's sanitized.
- The bad news is, the filter works much harder and needs more maintenance and chemical cleaning.

Success with biguanide demands diligent filter maintenance:

- Filters should be chemically cleaned with **SoftSwim® Filter Cleaner®** every four to six weeks.

- The sand should be replaced every one to three years.
- Cartridge elements should be replaced every two years.

If the filter is not cleaned properly, the plugged-up filter will slow the water flow. The water will become cloudy due to poor filtration, inadequate circulation, and insufficient chemicals. By the time the water turns cloudy the problem is already too big to solve easily.

A Word About Cleaning

Biguanide pools should be cleaned regularly. Much of the dirt and debris that floats on the water, clings to walls, and sinks to the bottom is negatively charged. It can keep the PHMB so busy that it does not have time to kill bacteria.

By brushing the walls, skimming the surface and vacuuming the bottom, you remove these distractions and the PHMB is free to concentrate on killing bacteria.

The Ideal Biguanide Pool

A pool maintained on a biguanide system requires an owner who understands his maintenance responsibility. In addition, the ideal pool should have:

- A capacity of 25,000 gallons of water or less
- A vinyl surface
- A sand filter

Does this mean that a 27,000 gallon plaster pool with a D.E. filter should not be on *SoftSwim*®. Maybe, but its key to inform the pool owner of the maintenance responsibilities that go with such a choice.

Oxidizing A Biguanide Pool

When PHMB kills bacteria the cellular contents “bleed” into the water. These and other undesirable compounds must be removed to keep the water sparkling and clean. Some of this is picked up by the biguanide itself. The rest will need to be oxidized.

27.5% Hydrogen Peroxide (H₂O₂) is used to oxidize a biguanide pool. Hydrogen peroxide is a very powerful oxidizer. This product is added approximately every four weeks but should always be maintained within the specified range. Under no circumstances should the Hydrogen Peroxide level be allowed to fall below 20 ppm.

IDEAL HYDROGEN PEROXIDE (H₂O₂) LEVEL: 20 - 60 ppm

Assist® - The Answer to the Slime and Mold Problem

When problems occur in a SoftSwim® pool, one of the most frequent issues is the lack of simple and effective treatments for molds, slimes and algae including pink slime and white water mold. While other types of slime and mold can occur, pink slime and white water mold are the most common types found in biguanide treated pools. Some common characteristics of pools experiencing growths of these slimes and molds include cloudy water, increased consumption of clarifier/ shock, material growing from within the plumbing system and filter. Slime and mold usually take over a year to become evident and can occur even in pools that consistently follow recommendations if the physical characteristics of the pool are not optimum for biguanide.



New SoftSwim Assist is a patented technology that can be used as a curative and as a maintenance product to cure or prevent mold and slime growth. This product attacks the problem at the source, in the circulation system. Mold and slime grow in the plumbing and filtration system of the pool. By working specifically in these areas, SoftSwim Assist kills these organisms and controls their growth. SoftSwim Assist is not a recommended treatment for algae.

SoftSwim Assist has application directions for both a curative and a maintenance product. As a curative, following the initial application, a second application is made 5 to 7 days later. Once these two applications have been made, the maintenance program is begun. The maintenance program directs application of the product every 3 to 4 weeks. SoftSwim Assist is recommended at pool start-up, every 3 to 4 weeks during the season and once at pool closing to prevent slime and mold growth.

Consumer benefit claims:

- Controls mold and slime build up
- Keeps SoftSwim pools crystal clear
- Reduces excessive use of SoftSwim Clarifier C
- Kills mold and slime in circulation system



Aseptrol and the Aseptrol logo are trademarks of Engelhard Corporation.

Biguanide Keys

- Biguanide (PHMB) is an effective non-halogen sanitizer
- Ideal PHMB range is 30 - 50 ppm.
- PHMB is positively charged and attracts negatively charged bacteria and debris.
- Large PHMB particles are easily filtered out and filter cleaning is critical.
- The ideal biguanide pool has less than 25,000 gallons of water, a sand filter, a vinyl surface, a bottom drain, and an educated owner.
- A solution of 27.5% hydrogen peroxide (H₂O₂) is used to oxidize PHMB pool.
- The ideal level of hydrogen peroxide (*SoftSwim*® Clarifier C) is 20 to 60 ppm.
- Biguanide and halogens are totally incompatible.

SoftSwim® - The BioGuard® Biguanide Program



Following the theme of program chemistry, BioGuard® **SoftSwim**® is a complete biguanide program. If a non-chlorinating sanitizing system is preferred, recommend the ABCs of SoftSwim for soft, gentle pool water. SoftSwim is easy to use and gentle on the customers skin, eyes and hair!

SoftSwim B® is the PHMB sanitizer, **SoftSwim Clarifier C**® is the hydrogen peroxide oxidizer, and **SoftSwim Algicide A**® is the algae inhibitor.

All the SoftSwim products are liquid for effortless application. No mixing or pre-dissolving needed! The three steps of this program are:

A: SoftSwim A to prevent algae

B: SoftSwim B to sanitize water

C: SoftSwim C to keep water sparkling

SoftSwim is the ideal program for residential pools with the following characteristics:

- Not more than 25,000 gallons
- Good circulation, using a sand filter
- Pump operates at least 12 hours per day
- Any surface type, but especially great for vinyl-lined pools