



**COTEY
CHEMICAL
CORPORATION**



agricultural



industrial



municipal



residential

Brad Cotey
Founder, 1949

**Water Well Development,
Rehabilitation and Maintenance Solutions**



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INTRODUCTION

Cotey Chemical Corporation was founded in Lubbock, Texas in 1949, by Mr. Bradford J. Cotey. Our mission is to provide products that can be safely and easily applied by non-technical personnel to maintain, develop and/or sanitize all types of water wells.

For over 70 years, Cotey Chemical has earned a reputation as a leader for developing superior water-well chemical products. Satisfied clients, throughout the United States and many foreign countries, attest to the claim of Mr. Cotey's motto - "BETTER WELLS WITH COTEY CHEMICAL".

This manual was written to provide guidance when using Cotey Chemical products. All the data has been gathered from actual experiences, but the particular suitability for a specific application should be substantiated by each user.

Neither Cotey Chemical Corporation nor any of its agents can guarantee specific results or assume obligation or liability in connection with data provided in this manual.

TESTIMONIALS

“Cotey Chemical has been providing products and services to our company for the past eight years. As a result we have increased our services to our customers with excellent results and profits.”

Sergio A. Leon Zamudio
Pozos Dinamicos, S.A. de C.V.
Hermosillo, Sonora, Mexico

“Cotey Chemicals work better in our area than any other brands we’ve tried. As far as we’re concerned they are the best on the market.”

Don Duerst
Duerst Machine Works
Burlington, Colorado

“We’ve been using Cotey Chemical products since 1960 and have been very pleased.”

Bill Swaringen
Brownfield Irrigation
Brownfield, Texas

“We’ve recently constructed an 8” municipal well that produced 80 GPM - 500’ depth. During the grouting, approximately 70 bags of cement ended up in the well and blocked all water from entering the well. We used Dry Acid Special three weeks after grouting and restored yield to 80 GPM. Valley Drilling Corporation of Virginia will be using Cotey Chemical products for all well cleaning.”

Dennis W. Singhas
Valley Drilling Corporation
Upperville, Virginia

“I am confident in the integrity of Cotey Chemical Corp. and trust their products.”

John Bonsangue, R.G.
Hydrogeologist
Orange County Water District
Fountain Valley, California

CHEMICAL INVESTMENT PAYBACK

In order to appreciate the undeniable value of a clean, efficiently-performing well it's important to first remember some facts about water well production.

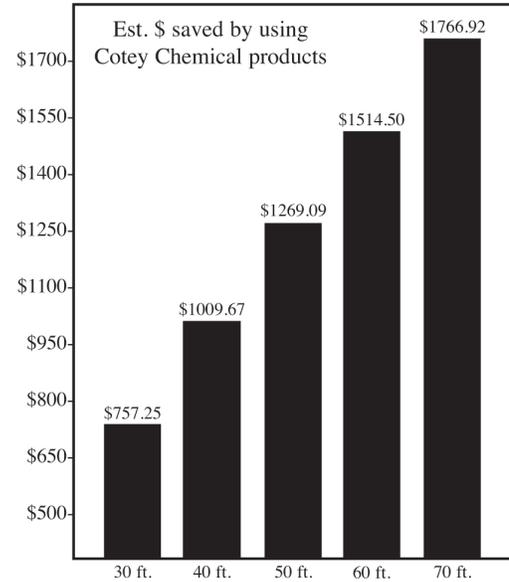
When a pump is turned on, the water in the well "draws down" a certain distance. This water draw down, added to the normal static depth of the water (the distance from the ground to the water surface), becomes the total distance the pump must lift water to the surface. The greater the lift, the harder the pump must work and the higher the energy cost. It makes good economic sense, then, to keep the draw down as low as possible.

The question then becomes, how can the drawdown be effected? The answer to that question begins with the condition of the water-bearing formation and, when in place, the well screen and gravel pack.

While water is being pumped out of the well, more water is pouring in (recharging), usually through the well screen, gravel pack and the formation itself, replacing that being pumped out. Normally if the water pathways are clear, the well recharges quickly and the draw down is minimal. But, if because of well screen and/or water-formation plugging the water pathways are blocked, the well can't recharge as quickly as it should, increasing the water draw down, adding to the work load of the pump and raising fuel costs to produce the same amount of water.

Cotey Chemical has known, since 1949, that water pathways can be cleared with Cotey Chemical products. When pathways are unobstructed water flow is restored and the well recharges more quickly. Keeping a well clean will reduce energy costs, reduce wear on the pump and increase the life of the well.

One of the most immediate benefits is lower energy cost. To give an idea of the impact Cotey products can make on energy costs consider the following example:



This graph shows the additional annual electric fuel cost for each additional 10 feet the pump has to lift water out of the well. Or stated another way, this is the estimated dollars saved by using Cotey Chemical products. (see table for calculations)

Assume a well is pumping 300 gpm with 300 feet of lift. The annual electric cost, according to the chart below, will be about \$7,575.55 to produce 110.48 acre-feet of water. If, however the formation and well screen are cleaned with Cotey Chemical products, the water lift will decrease. Let's say it decreases to just 250 feet. This causes the annual fuel cost to decrease to \$6,313.46. That's a savings of \$1,262.09 per year. When adding lower wear on the pump, higher pump efficiency and other cost effects it's easy to see that an investment in Cotey Chemical well-cleaning products will not only pay for itself in one year, but will continue to add value to the well year after year. Moreover, developing each well to its maximum potential using chemical well treatment may reduce the total number of wells needed for a particular job.

Energy use and electric fuel cost of pumping water							
	(Q)	(X)			(Y)	(Z)	
GPM Well	Water lift in feet	Annual fuel cost in \$US	Additional 50ft lift	Resulting annual fuel cost in \$US	Additional annual fuel cost	Assumed overall pump efficiency	Annual acre-feet of water produced
100gpm	150ft	\$ 1,646.99	200ft	\$ 2,194.63	\$ 547.64	34.35%	36.83
300gpm	250ft	\$ 6,313.46	300ft	\$ 7,575.55	\$1,262.09	44.79%	110.48
500gpm	350ft	\$14,181.82	400ft	\$16,209.19	\$2,027.38	46.52%	184.13
750gpm	400ft	\$22,872.98	450ft	\$25,730.01	\$2,857.03	49.46%	276.20
Assumptions:		2000 hour average annual pumping season					
		\$0.10 power cost per KWH					
		1.024 KWH required to lift 1 acre-foot of water 1 foot at 100% overall efficiency					
		1 acre-foot = 325,851 gallons					
		(((1.024 x Q) x 0.075) / Y) x Z = X					
Data provided by High Plains Underground Water Conservation District No. 1							

WATER WELL CHEMICAL TREATMENT

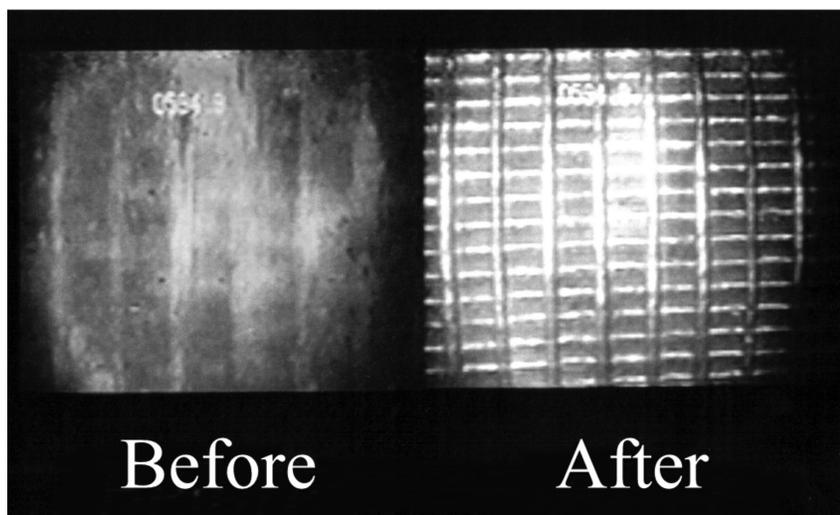
Any water well can be treated with any number of chemicals at any time, but such treatments do not necessarily benefit the well or increase productive capacity. For example, new water wells developed in crystalline rock (granite, diorite, monzonite, ...etc.) can seldom be improved by acid treatments, and no chemical can increase the production of wells that have simply pumped all of the available water. It is therefore important, when considering a chemical stimulation program, to correctly identify the reason(s) for the decreased well yield. Cotey Chemical personnel will gladly help you with such problems.

Decreased water well yields may result from many independent, or several contributing factors. The proper steel may not have been used during well construction and considerable corrosion of the well screen or casing may have occurred. Pumping velocities may have been excessive, or a poor gravel-pack construction may be allowing too much silt and clay to pass. Well yield may decrease because of movement in the well screen or casing, or because of incrustations of calcium carbonates and iron and manganese hydroxides/hydrated oxides and bacterial slimes, or because of simple silt and clay plugging. Most of these problems can be successfully alleviated with chemical treatments – particularly by using products developed by Cotey Chemical. Many contractors believe that recent developments of various exotic metal alloys and plastics for well casings and screens prevent incrustation problems, but studies document that plastic screens and even fiberglass pipes do experience incrustation problems in many areas. Therefore, let's examine each of the principle clogging mechanisms, the recommended treatment programs needed for correction, and specific Cotey Chemical products.

First a word about the time necessary for good chemical treatment of a water well: The rate of virtually all chemical reactions increases

as the temperature increases. Warmer water decreases reaction time and decreases well “down time”. Unfortunately, in most cases, well water will be cool (< 60 degrees F). Therefore the time needed for adequate chemical treatment may seem unusually long and is sometimes cut short by impatient landowners, drillers or service companies. This is, of course, tantamount to using the wrong chemical or less than required amounts of the right chemical, either of which is bad business for all concerned. Cotey therefore recommends that if the well cannot be shut down for the needed time period, the chemical treatment should be postponed until the required “down time” can be scheduled.

This catalog attempts to outline the various specific applications of Cotey Chemical products. The use of complex chemical equations, technical terminology and involved reactions is kept to a minimum although a certain familiarity is required for a competent knowledge on the part of representatives, service companies, and local advisory personnel. Cotey Chemical realizes that wells often exhibit what might be termed “individual idiosyncrasies”. Therefore Cotey encourages product users to contact the company for technical assistance. We can also supply professional supervisory personnel for developing large, deep wells or treating a large well field.



WHAT MAKES A GOOD WATER WELL

There are three main ingredients that go into making a good water well: drilling, pumping, and developing. The first two are indispensable since an opening of some kind has to be made in the water-bearing formation and some means has to be supplied for lifting the water to the surface, even if it's only a bucket tied to the end of a rope.

For the first ingredient, various drilling methods may include: direct and reverse circulation, rotary, cable tool, scow, driven points and even hand dug wells. Once the hole is made, the casing and screen must be set, a strainer or liner added, then cement, gravel-pack and whatever other work is needed to create the well.

For pumping we can include all means of artificial lift, such as deep well turbine, jet, rod, submersible, centrifugal, and other pumps. We can also include air-lift and natural artesian flows.

The third ingredient, well development, is often neglected. For example, wells are drilled, a pump is installed and the flow rate is accepted even though it may not be what is needed or desired. Many conclude that this is all the water available from the formation. Our experiences indicate that more water is often available and the flow could be increased with proper well development.

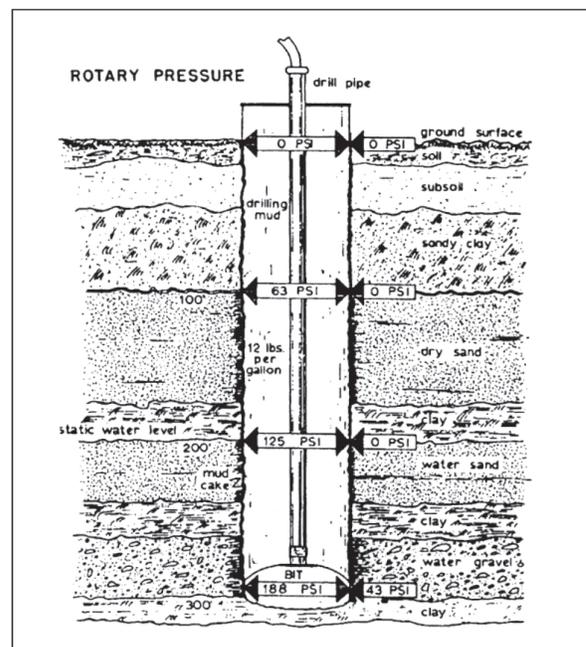
DEVELOPING THE WELL TO ITS MAXIMUM CAPACITY

Mechanical methods used for developing water wells include: bailing, pumping, back washing or back lashing with the pump, surging with a surge block or with compressed air, using explosives, jetting, and fracturing. In all these mechanical efforts to open up the perforations by force, pressure is applied from the well bore out into the formation. This is the same direction pressure was applied during the drilling operation, plugging some of the water pathways in the process.

In order to drill, a fluid is usually circulated to remove the cuttings and stabilize the hole. In most cases mud is considered the fluid of choice. Commercial drilling mud can be purchased and used for this purpose, or enough natural-occurring clay exists in the formation

to form the needed mud. Mud should also be the proper type and consistency. If the mud is too thin, circulation may be lost and all the mud will go back into the formation making it difficult to remove later. If the mud is too thick it becomes heavy and harder to circulate and will tend to stick the bit.

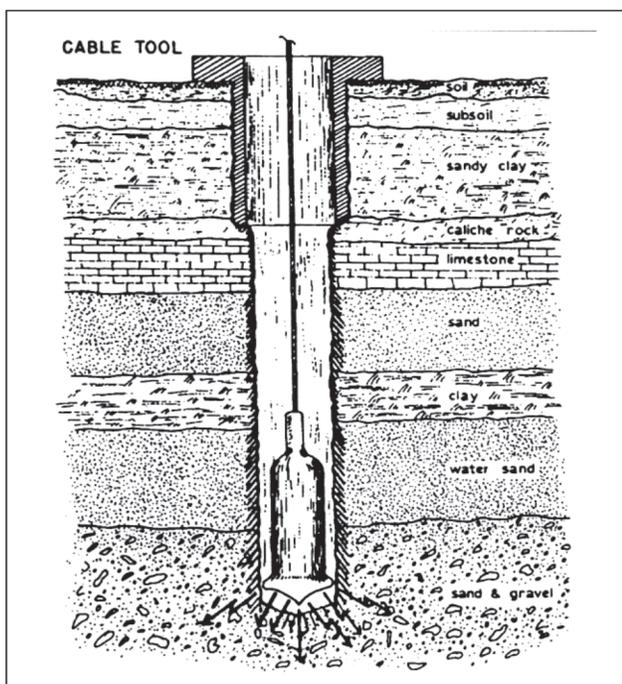
The "Rotary Pressure" illustration shows some of the results when a well is drilled with the rotary method. These will occur whether the drilling is by direct or reverse circulation. When considering the pressures and methods used to drill it seems almost impossible to drill a well without plugging off at least some water.



After the well is drilled all the mud cake must be removed if the well is to be developed to its maximum capacity. According to the illustration, at the static level of 200 feet, mud was put in place with 125 psi pressure; at 300 feet, 188 psi. After most of the mud has been removed from the well by bailing or pumping there is normally some left on the wall of the hole and in the formation. The only available means to push the mud off the wall and/or out of the formation is the head pressure of the water in the formation. At the static water level of 200 feet there is no head pressure. At 300 feet the maximum pressure would be only about 43 psi and this is only if the formation had uniform vertical permeability - which is rarely if ever found. There usually will be several clay or shale breaks which will reduce the total pressure.

So we now have the following condition – mud put in place under 125 psi at the static water level and no water pressure to remove it, and mud put in place under 188 psi at 300 feet with at most only 43 psi water pressure to push it out. Naturally, the deeper the hole and the less standing water there is, the greater the differential pressure.

With cable tool or spudder drilling, the same thing occurs but the pressure is applied in a different manner. The “Cable Tool” illustration shows roughly what happens. As the heavy tool is raised and dropped a tremendous force is developed on the face of the bit. This force acts in a direction at right angles to the face of the bit. As a result, as drilling progresses, the



formation around the well bore is compacted and the mud and slush in the hole is pounded back into the formation. Here again, the only pressure available to remove any plugging is the water head pressure in the formation. This pressure will never be anywhere near the pressure used by the heavy tool string. Scow drilling and driving casing and reaming also have similar action which tends to plug off some water. The effect of this plugging is lower water flow and lower specific capacity.

In a sand and gravel well, mud-cake ends up on the wall and in the formation compacted around the well bore. Since this is behind the casing or screen and

behind the gravel pack, purely mechanical means will not be effective in removing it. In order to get maximum capacity all the mud must be removed and the formation opened up to allow water to flow freely from the formation into the well bore.

The combination of properly-used chemical treatments and mechanical agitation methods are quickly gathering acceptance as the most effective process for removing mud and opening perforations and water-bearing formations.

Recognizing this, a great many chemicals have been dumped into wells in an effort to clean them up. Various acids have been used, soaps, detergents similar to household cleansers, water-softening chemicals, chelating agents, wetting agents, carbide and, believe it or not, Alka-Seltzer.

But, for a chemical treatment to work, the chemistry must match the problem. For example, some chemicals must be effective in dissolving, disintegrating, and dispersing commercial drilling muds, clays, and shales, so they can be easily bailed or pumped to waste. Others, when used to unstop a plugged well, should be capable of dissolving limestone and water-deposited scales, corrosion products, and organic growths.

Additionally there are requirements that any chemical should meet if it is to be used in a water well: It should be relatively non-toxic and should not contaminate the water; it should be safe to use on mechanical equipment in the well; it should also be safe and easy to handle. Finally, from the contractor or well service company standpoint, chemical treatments should be performed without the need of additional equipment.

With chemicals that have been developed specifically for treating water wells, it's now possible for a contractor or well service company to include chemical treatment along with their other services, adding additional profit to a job and making a better well for the customer.

Finally, before any chemical treatment will even be considered, the fact must be admitted or established that some water pathways were probably plugged during drilling. Some drillers may be reluctant to admit this possibility, considering it a negative reflection on their ability. Others claim that if the water is there they will get it. This is not always true. Many older wells

made more water after chemical treatment than when first completed, showing that some water pathways had been blocked from the beginning. Obstructed water pathways are often just a function of drilling and bear no reflection on the driller's ability.

DRY ACID® is a Cotey Chemical product specifically blended to help develop water wells to their maximum capacity. It is designed to remove clays, shales, drilled cuttings and commercial drilling muds from water wells. It is also excellent for "gravel slipping" and freeing stuck drill pipe. DRY ACID® will effectively prevent mud-cake build-up if used during well drilling or will quickly remove mud-cake after the well has been drilled. Also, DRY ACID® is better than the often-used canister of single phosphates thrown down the well to "clean out the muds". This is because single phosphates act as a food source for natural occurring bacteria.

DRY ACID® can also be used to break down "mud-cake" produced during the drilling operation. This "mud-cake", consisting of fine silts and clay particles, is often partially cemented or is made up of minute calcium carbonate fragments. Standard treatments using acid may aggravate rather than correct the problem. The acid-dissolving cations present in the clay allow free silicon dioxide (Silica, SiO₂) to precipitate out as a gel instead of dissolving it. DRY ACID® not only dissolves the "mud-cake" but acts as a strong sequestering agent preventing silt and clay particles from precipitating or flocculating out of solution. DRY ACID® may even be used to redevelop older wells produced in sand and/or gravel formations to their original flow or greater.

For wells developed in areas where carbonate is not a problem, mud-cake, silts and clays and even oil from oil-lubricated turbine pumps can be removed with Cotey Chemical's MUD-NOX®. MUD-NOX® is a superior wetting agent and emulsifier that disperses silts and clays, allowing the particles to be pumped to waste instead of collecting in the well. The emulsification properties ensure that any oil in the well will mix with the water to be pumped to waste. MUD-NOX® also disperses mud during the bailing process and may be used as a drilling additive to reduce solids build-up, decrease friction, aid in suspending solids and help remove mud-cake, silt and clay from the well during the drilling process. As a multi-purpose surfactant/polymer with a broad range of useful

applications, MUD-NOX® is an excellent addition to Cotey's DRY ACID® for getting all the water possible from the drilled well.

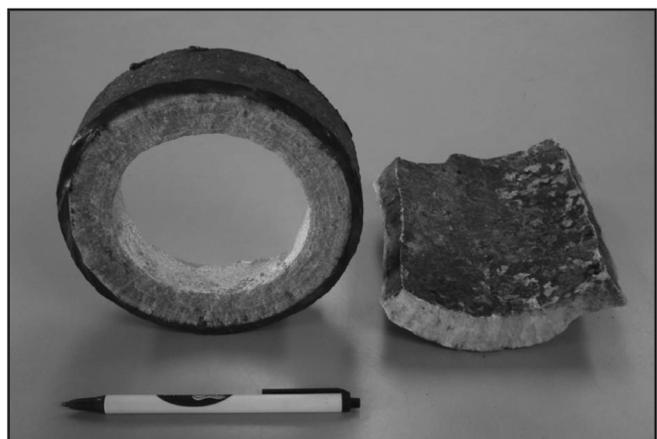
COMMON WATER-PLUGGING PROBLEMS AND COTEY'S SOLUTIONS

Calcium Carbonate Scale

Probably more water wells experience decreased yields due to incrustations of calcium carbonate (CaCO₃) or calcium magnesium carbonate (CaMg(CO₃)₂) than from any other type of incrustation. Carbonate scales form mainly in water wells producing from hard water aquifers in hard water areas of the United States.

Acids vigorously attack hard water scales. The two most commonly used acids in the water well treatment industry are muriatic (hydrochloric acid, HCl) and sulfamic (HSO₃NH₂). Sulfamic acid is the basis for Cotey Chemical's DRY ACID® SPECIAL. HCl is one of the basic chemicals in Cotey Chemical's LIQUID DESCALER.

Contractors use HCl (muriatic acid) in wells plugged by carbonate scales usually because of its availability, cost and ability to dissolve most hard water scales. However, because of the possibility of "blowouts", the absence of inhibitors, and various safety precautions that should be followed when using HCl, Cotey Chemical strongly discourages using HCl by itself.



The result of adding gallons of HCl (muriatic acid) into a water well drilled through or into limestone and/or dolomite is often a "blowout". A "blowout" is when the acid and water mixture in a well "blows" out the top of the well – in this case due to the rapid production of huge quantities of Carbon dioxide (CO₂) gas. CO₂

METALS	DRY ACID® SPECIAL	MURIATIC ACID	SULFURIC ACID
1010 steel	1.0	4.2	2.6
Cast iron	1.0	3.2	3.2
Galvanized	1.0	rapid	63.0
Tin plate	1.0	23.0	81.0
304 Stainless	1.0	resistant	10.0
Copper	1.0	6.7	1.5
Brass	1.0	2.8	1.5
Bronze	1.0	7.0	4.0
Aluminum	1.0	5.3	0.6

Table 1 - Relative corrosion rates of various metals commonly used in water wells from DRY ACID® SPECIAL, muriatic acid and sulfuric acid.

gas evolves very quickly when HCl comes into contact with limestone or dolomite. As the gas ventilates out the top of the well it pushes the column of acid-water up and out right along with it, contaminating the surrounding field, trucks, people, and anything else it touches. It makes a mess and is very difficult to clean up.

To prevent well-screen destruction and the casing from pitting, an inhibitor is necessary for any water well acid. Table 1 depicts the relative corrosion rates of various metals commonly used in water well construction when treated with DRY ACID® SPECIAL, commercial muriatic acid, or commercial sulfuric acid. As illustrated, commercial muriatic acid dissolves most metals much faster, for instance with 1010 steel over four times faster, than Cotey’s DRY ACID® SPECIAL. That’s because Cotey Chemical uses a very effective inhibitor in its DRY ACID® SPECIAL. DRY ACID® SPECIAL is a non-toxic, non-explosive and non-fuming granular product. It can be slowly and safely added to a water well without special training or special holding tanks and hoses. The slower reaction rate of DRY ACID® SPECIAL reduces the possibility of a “blowout”. Moreover, this slower reaction allows DRY ACID® SPECIAL to be pushed further into the water-bearing formation than HCl (muriatic acid), exposing it to more clogged surfaces. Also, because it’s a granular product, no emergency exists if a spill does occur.

DRY ACID® SPECIAL also has a blend of polymers that are designed to suspend large amounts of calcium, magnesium, and iron minerals that are released as the acid dissolves deposits. This allows more material to be removed when pumping the spent chemicals

to waste. The result is a better, more complete well rehabilitation.

LIQUID DESCALER is a potent combination of acids, surfactants, inhibitors, and dispersants. LIQUID DESCALER dissolves mineral scales and then keeps them in solution to be flushed to waste. One of the main chemicals used in LIQUID DESCALER is hydrochloric acid (HCl). HCl is a very potent acid capable of dissolving a variety of hard water scales in a minimum amount of time. While Cotey Chemical recognizes the value of HCl for down-hole applications in hard water areas, we are also aware that it is highly reactive with most metals. We have therefore added an excellent inhibitor to LIQUID DESCALER that protects the casing from pitting and the screen from being damaged.

Cleaning the well screen and gravel pack is just part of the solution. Limestone is calcium carbonate. It is completely soluble in acid. Limestone aquifers precipitate hard water scales onto the well screen and the gravel pack. But scale also builds up in and around the cracks and fissures in the formation through which water travels to arrive at the well. Scale builds faster around the areas where water flow velocities are higher. Therefore, the biggest restrictions are right at the place in the aquifer where the well has been drilled. Using chemicals to dissolve the limestone scale and also part of the limestone formation causes channels leading into the well bore to enlarge, allowing more water to enter and the flow to increase.

It isn’t necessary to get deep penetration into the formation in order to get big increases in yield. Increasing the area just around the well bore is sufficient. It is similar to having a system with a great many one-inch pipes all connected to a one-inch common header. The capacity of the system is limited to the capacity of the header regardless of how many one-inch pipes are connected to it. To increase the capacity of the system, the size of the header must be increased. Essentially this is what is done when the area around the bore hole is opened with an acid treatment.

Iron and Manganese scale

Ground water commonly contains iron in solution as ferric (Fe³⁺) or ferrous (Fe²⁺) salts. Fe³⁺ in solution in amounts greater than 0.01 ppm occurs only when the water pH is less than 5.0. So this is usually

not a problem. However, Fe^{3+} allows the growth of iron-fixing bacteria such as Siderocapsa, Gallionella, Crenothrix, Leptothrix, and Spirophyllum ferrugineum which oxidize dissolved iron and manganese. This causes iron and/or manganese scale and/or slime precipitate. The sulfate-reducing bacteria Desulfovibrio also produce an iron slime. Manganese hydroxide or manganese carbonate is produced by bacteria extracting manganese from plant life. Within the well, deposits of ferric oxide scale will be brownish to reddish brown whereas the hydrated ferrous oxide and the manganese oxide will be a black to very dark brown.

Manganese (Mn) also occurs in well water in two oxidized states. The typical reaction that occurs when water containing manganese is pumped to the surface is simple oxidation, forming manganese hydroxide ($Mn(OH)_2$ and/or $Mn(OH)_3$). Manganese in ground water results from leaching soils, industrial wastes, and bacterial contributions (amounts that exceed 0.30 ppm are harmful for human water supplies). Most ground water contains less than 0.20 ppm manganese, but in mining areas or areas that experience leaching by water that has been reduced, Mn may exceed 1.0 ppm.

Iron scale, calcium carbonate, manganese hydroxide, and manganese carbonate scales are all soluble in mineral acids, therefore Cotey Chemical's DRY ACID® SPECIAL or LIQUID DESCALER are the recommended products. In wells that also have plugging from slime-forming bacteria, iron/manganese-oxidizing bacteria and sulfate-reducing bacteria, LIQUID DESCALER is recommended.

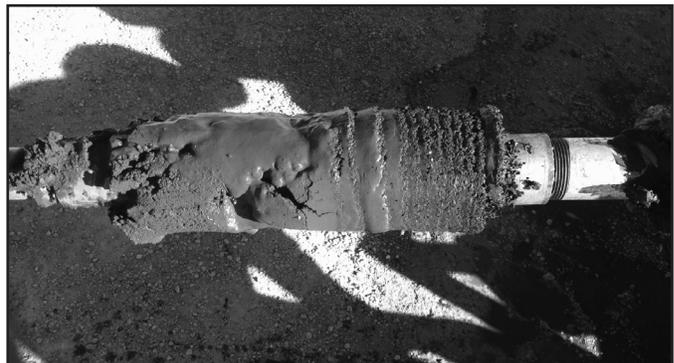
When using acid to rehabilitate a well, it is a good practice to monitor the pH of the well water during the process. When pH rises to 3.0 or above the product is losing strength and effectiveness. Begin by adding the recommended dose of chemical and then monitor the pH after each agitation. If the pH rises above 3.0 add more product. This process allows for a more accurate chemical treatment, which prevents over-treatment or under-treatment.

Bacteria, Slime, and related Biofouling

Cotey Chemical has developed a product with a blend of organic acid and uniquely designed polymers called BIOCLEAN. BIOCLEAN is designed to be used with a strong mineral acid, like Cotey's DRY ACID® SPECIAL, to aid in suspending dissolved minerals

and break down biological growths. BIOCLEAN is a potent combination of acids, inhibitors and dispersants. It breaks down biological growths and, when used with DRY ACID® SPECIAL, dissolves mineral scales and keeps them in solution to be flushed to waste. It also dissolves the slime produced by bacteria, including slime-forming, sulfate-reducing, and iron/manganese oxidizing bacteria. Once all the biological growths are broken down and the minerals are dissolved, the dispersants in BIOCLEAN "tie up" these particulates allowing them to be flushed from the well.

LIQUID DESCALER is a blend of polymers, surfactants, inhibitors, and both mineral and organic acids. As such, LIQUID DESCALER is similar to DRY ACID® SPECIAL and BIOCLEAN blended together into one product. The acids in LIQUID DESCALER work together to dissolve mineral deposits and biological fouling and then, like BIOCLEAN and DRY ACID® SPECIAL, hold the dissolved particulates in suspension to be pumped to waste.



Cotey has also developed a WELL CLEANING BRUSH designed to scrub the inside of well screen and act as a type of surge block. Our studies show that brushing the well, prior to chemical treatment, can remove interior screen deposits ensuring more uniform chemical access to the screen. Cotey's WELL CLEANING BRUSH and LIQUID DESCALER provide a staggering one-two punch that has proven successful in wells all over the world. Once the biological growths are broken down and the minerals are dissolved the well is ready for chlorination.

CHLORINATION

The accumulation of nuisance organisms such as fungi, algae, molds and various bacteria is a real problem in some areas. Generally speaking, this problem is best

solved by preventive treatments rather than waiting until the well is plugged. Usually these organisms can be controlled if every well is sterilized with some accepted method when the well is first completed and then treated periodically. Of course it's of prime importance to construct the well in such a way as to eliminate any surface contamination.

All water wells, even if used for cropland irrigation, stock or industrial purposes, should be periodically sterilized. The common test for water pollution is for the presence of coliform bacteria which originates in the intestinal tracts of warm-blooded animals. Certainly, the presence of any coliform content in well water shows that other pathogens may also be present which could transmit dysentery, infectious hepatitis, burcellosis or salmonellosis to humans, or scours to swine and livestock. In fact, although caution is seldom exercised in supplying stock water, polluted water will produce a higher than average mortality rate in most animals, being particularly noticeable in slow weight gains and abortions in swine and cattle.

The standard method of treating water supplies for bacterial pollution is by chlorination. Chlorination is adding chlorine to water to produce hypochlorous acid (HOCl). Disinfecting chlorine usually comes in one of four forms: chlorine gas, sodium hypochlorite (liquid bleach), calcium hypochlorite (granular chlorine) or sodium dichloroisocyanurate dihydrate.

Because chlorine gas so efficiently produces hypochlorous acid it's the most effective chlorinating tool available for killing bacteria. However, it is difficult to handle and dangerous to humans and animals alike.

Sodium hypochlorite is a liquid product usually obtainable in 5-12% available chlorine. The problem with sodium hypochlorite is that it has a very short "shelf life". This grocery store bleach product is made with 5.5% available chlorine and 94.5% water. But, because the chlorine gas is highly unstable in water, it will quickly break down into mostly salt water if not used in a few months. For years it has been customary for drillers and household occupants to "disinfect" their water wells using household bleach. This method is almost totally ineffective because of the low level of chlorine concentration in the bleach and the small amount of bleach commonly used. As a typical example, let's take a 400-foot deep, 12-inch well with 300 feet of water. This well contains about 1765 gallons of water. In order to reach a chlorine concentration

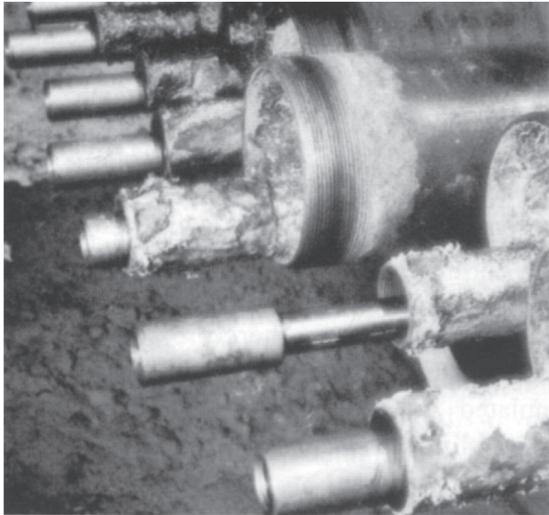
of + or - 200 ppm, 7 gallons of bleach is required. Unfortunately, treating this well with the "supermarket method" would probably consist of dumping one jug of laundry bleach down the hole rather than the 7 gallons actually needed to do the minimum job.

Calcium hypochlorite is a granular product usually obtainable with 60-70% available chlorine. It is easier to handle and store than chlorine gas and is relatively stable in that it retains 90% of its chlorine content for 12 months after manufacturing.

Here at Cotey Chemical Corporation we have our own solution for purifying water wells: WEL-CHLOR PLUS. This product contains sodium dichloroisocyanurate dihydrate. While the other chlorine options have certain benefits, Cotey believes this chlorine product is unsurpassed. It is very easy and safe to use, is relatively inexpensive, dissolves up to five times faster than calcium hypochlorite and is extremely stable. This stability is what makes it so beneficial: WEL-CHLOR PLUS off-gasses more slowly making it safer to handle and giving it a longer shelf life, and in a water well has a slow release of relatively low chlorine concentrations at a constant rate resulting in longer residual action and a longer disinfecting time. It also completely decomposes leaving the well water clear and clean. Cotey Chemical recommends using WEL-CHLOR PLUS to purify the water in old water wells and systems, remove nitrates, iron, sulfites (not sulfates), and manganese, treat algae, fungi and bacteria (including slime-forming, iron and sulfate-reducing bacteria).

When either sodium or calcium hypochlorite or WEL-CHLOR PLUS is added to water the available chlorine produces hypochlorous acid (HOCl), a potent, fast-acting disinfectant. In fact hypochlorous acid is the workhorse in any chlorine application. The amount of hypochlorite or WEL-CHLOR PLUS required to create sufficient quantities of HOCl depends on:

- Bacterial numbers: If there are large numbers of aerobic or anaerobic bacteria in the water, a higher chlorine dosage is required to ensure that all disease-causing organisms have been destroyed
- pH: Hypochlorous acid will form most readily in waters ranging from pH 6 to 7.5. As the pH increases above 7.5, HOCl increasingly dissociates to the hypochlorite ion, which is up to 200 times less effective as a disinfectant than HOCl. With a pH under 5.5, the concentration of HOCl is reduced



Pipes covered with bacterial growths

and chlorine gas begins to form. Chlorine gas is a powerful irritant that can damage eyes, nose, throat and lungs or may even cause death

- Temperature: Temperature affects disinfecting speed (higher temperature = faster disinfection)
- Turbidity: Any suspended particles (turbidity) will interfere with chlorine's disinfecting ability. Enough sodium or calcium hypochlorite or WEL-CHLOR PLUS must be added to the well to deal with this turbidity and then have enough left to purify the water. The better solution is to remove as many suspended particles possible by pumping or developing the well first and then add the chlorine product

Another benefit of WEL-CHLOR PLUS is that it is pH is neutral. Both sodium and calcium hypochlorite will raise the pH of whatever water to which they are added. WEL-CHLOR PLUS will not.

To purify the water in a water well add WEL-CHLOR PLUS to a tank of water. Then check the pH. Sometimes ground water has a higher or lower pH than desired to effectively produce hypochlorous acid. If the pH in the water tank is higher than 7.5, not much sanitizing will take place in the well. So, the pH will need to be lowered. Cotey's CHLORINE ENHANCER is designed for just this purpose. It is formulated to lower pH in a controlled fashion unlike many strong acids on the market. Use CHLORINE ENHANCER to lower the pH of the tank water to about 6.5. If the pH is lower than 6 it needs to be raised. There are good products, like soda ash, that can

be added to raise water pH. Since the goal is to produce as much hypochlorous acid possible with the chlorine solution, the pH needs to range from 6 to 7.5.

Chlorine cannot kill bacteria it doesn't contact and bacteria are usually present all through the well, gravel pack and formation. So, the chlorine solution must be evenly distributed throughout the system. To ensure this, Cotey recommends blending an amount of water and WEL-CHLOR PLUS that will approximate 3-4 times the volume of water in the well (it may be necessary to make several smaller batches) and then adding this to the well. Agitate the well every few hours, for 8 hours or so, using a surge block, jetting tool, or one of Cotey's WELL CLEANING BRUSHES to do the job. The bristles on Cotey's WELL CLEANING BRUSHES are so tightly placed that they act, not only as a scrubber on the inside of the well, but as a surge block giving the service provider a "plunger" effect not available with most handmade brushes.

Chlorine is a great product to use for disinfecting water wells, an important step in well rehabilitation. However, chlorine is not a complete rehabilitation chemical. It is very effective at oxidizing and killing free-swimming bacteria, but is ineffective if the bacterium in the well are encapsulated in slime because it doesn't penetrate the slime barrier very effectively. The problem in these wells is not simply to kill the bacteria but to remove the slime harboring the bacteria.

Likewise, we know that 70-80 % of all wells in the United States have a buildup of mineral deposits. Mineral deposits not only block water flow, but also allow bacteria to attach to an otherwise clean surface. Cotey Chemical has several products designed to penetrate and dissolve mineral deposits and biological slime. What's left in the water well then are dissolved solutes. These dissolved solutes, whether mineral or biological, should be pumped to waste prior to chlorinating.

OIL-LUBED PUMPS, ROOTS, AND MORE

When a water well contains considerable amounts of oil (probably from oil-lubricated pumps), organic slimes, tree roots and vegetative debris, or even carcasses of small animals, Cotey's WELGICIDE CLEANER® should be used. WELGICIDE CLEANER® is a highly alkaline chemical blend with detergency, sequestering, deflocculating, and buffering properties. As such, WELGICIDE CLEANER® is one of the most versatile and effective chemical treatments offered by Cotey.

MAINTENANCE TREATMENT

Water well deterioration is somewhat analogous to dental disease. Once the disease destroys a certain amount of bone structure, the teeth become relatively useless. Similarly, once encrustations reach a certain point in a water well, trying to extract water from the well becomes useless. Fortunately, water wells, like dental structure can be kept in optimum operating condition by preventative treatments; Cotey Chemical recommends such treatments for a well at least once a year. Needless to say, it is far easier to prevent incrustations and corrosion than it is to remove them.

Studies show, and our experience has confirmed, that the typical water well will be efficient for the first 10-12 years of its life. (The national average is 12 years. This number will differ based on how often the well is run and how many nutrients/minerals are in the water). But after 12 years most wells require some type of rehabilitation. Actually, most wells begin to experience efficiency declines way before they are rehabilitated.

Our studies show that once a well has been drilled (or rehabilitated) it is more cost effective to perform regular chemical maintenance than wait 12 years to perform a complete rehabilitation. Regular well maintenance increases the life of the pump, reduces energy costs and increases the life of the well. Regular well maintenance will also keep the bacteria count down, mineral scales removed and generally keep the surfaces clean. It will also reduce the possibility of pulling the pump and performing full rehabilitation, or at least extend the amount of time before full rehabilitation is necessary.

Maintenance cleaning should be done on a regular basis. The cleaning can be performed from once a month to once a year depending on how quickly the blockage builds. It can even be performed with the pump in the hole.

CONCLUDING REMARKS

The flow loss in many wells is due simply to a lowering water table. In this case, nothing can be done except drill more wells or use less water.

However, for the majority of water wells, flow loss is due to biological and/or mineral deposits plugging the natural flow of water. At this point the problem is not how or why the water flow is obstructed but how best to remove the obstruction so maximum flow can be obtained. Some of the plugging will be removed by bailing, swabbing, surging, backwashing or pumping. Compressed air is also used to build up pressure and “air-lift” the well in an effort to remove all plugging. While mechanical agitation and air-lifting can certainly help loosen and/or remove some deposits, much of the flow will continue to be obstructed.

Chemicals that are effective in removing practically any type of water-pathway obstruction are available. Instead of spending a lot of time using mechanical methods to remove plugging, a properly designed chemical treatment will make it possible to do the job better and in less time.

Cotey Chemical has been designing products to unstop water wells for over 70 years. Our products are packaged in small, easy-to-handle containers and are intended to be used by licensed well-drilling contractors, pump companies, and well service companies. We are trying to make your job easier, safer and more effective. The next time you have a water well that’s not producing the water needed or desired, call Cotey Chemical Corporation. Satisfied clients located throughout the United States and in many foreign countries, attest to the claim of Mr. Cotey’s motto, “BETTER WELLS WITH COTEY CHEMICAL”.

BIOCLEAN

Use BIOCLEAN to:

- remove biofilm produced by slime-forming bacteria, such as that produced by iron-oxidizing and sulfate-reducing bacteria.
- improve rinse-out of well treated with mineral acid by dispersing carbonate, sulfate, magnesium and iron deposits.

How to use BIOCLEAN as a mineral acid enhancer:

- Brush the well with the COTEY WELL CLEANING BRUSH before chemical treatment. Brushing the well can remove interior screen deposits. This ensures more uniform chemical access into the formation. Other common mechanical cleaning methods include swabbing and jetting. Then bail the debris from the bottom of the well.
- Use 1 gallon (3.8 liters) of BIOCLEAN per 40 gallons (152 liters) of water in the well (see table). For heavy biofouling use 2 gallons per 40 gallons of water.
- Pour BIOCLEAN directly into the well. BIOCLEAN can also be premixed in an above-ground tank and introduced into the well from the top or injected into the screen area.
- Add DRY ACID® SPECIAL or other mineral acid directly into the well or blend it with BIOCLEAN in an above-ground tank. BIOCLEAN is safe to use with all mineral acids.
- Agitate the solution in the well with a tight-fitting surge block or other isolation tool, like the COTEY WELL CLEANING BRUSH, every two to four hours for 24-36 hours. A bailer, surge-block or other tool will also work. Dry ice can be used to agitate the chemical if a rig or pump is not available. This agitation dislodges material softened by the chemical treatment and pushes the chemical solution further into areas it may otherwise not be able to reach. The combination of both chemical and mechanical methods is vital to get the best results for the water well.
- When acidizing a water well it is best to check the pH frequently. When pH levels rise above 3.0 the acid is losing strength and productivity, therefore more acid should be added. Monitoring pH in this way allows for a more accurate chemical treatment.
- Pump or bail the hole clean, develop and test. Continue pumping until the pH of the water is within 0.5 pH units of the original value before treating. The initial treated water contains spent chemical and should be pumped to waste. Repeat the above steps as necessary to achieve optimum well production.

Some background information:

BIOCLEAN is a low pH, water-soluble, organic biocleaner specially formulated to dissolve slime and other biofouling issues caused by slime-forming, iron-oxidizing, and sulfate-reducing bacteria. It works with mineral acids, like Cotey Chemical's DRY ACID® SPECIAL, to remove encrustation from wells, screens and pump parts. It is fully inhibited and safe to use on plastics, rubber and metals commonly used in water well equipment. BIOCLEAN also helps remove debris from a well treated with mineral acid by dispersing carbonate, sulfate, magnesium and iron deposits in the well water.

How to dispose of BIOCLEAN:

BIOCLEAN is rapidly biodegradable. Waste from BIOCLEAN treatment should not be pumped to cultivated fields nor made available to livestock. Depending on quality used and condition of the well treated, waste may be near neutral to very acidic. COTEY CHEMICAL therefore recommends that waste be pumped to holding tank or pit for neutralization and disposal. (Local, State and Federal regulations should be adhered to.)

CAUTION:

BIOCLEAN may cause skin burns or eye damage. Therefore, always use goggles or safety glasses and neoprene or rubber gloves with cuffs. If BIOCLEAN gets in the eyes rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing and call a poison control center or a medical doctor.

If on the skin or hair, remove all contaminated clothing. Rinse skin or shower with water and call a poison control center or a medical doctor. If swallowed rinse the mouth with fresh water. **DO NOT INDUCE VOMITING.** Call a poison control center or a medical doctor.

BIOCLEAN is packaged in 1-gallon, 5-gallon, 55-gallon and 275-gallon containers.

Diameter of Casing or hole (inches)	Gallons of water per foot of depth
3.0	0.37
3.5	0.50
4.0	0.65
4.5	0.83
5.0	1.02
5.5	1.23
6.0	1.47
7.0	2.00
8.0	2.61
9.0	3.31
10.0	4.08
11.0	4.94
12.0	5.88
13.0	6.90
14.0	8.00
15.0	9.18
16.0	10.00
17.0	11.79
18.0	13.22
19.0	14.73
20.0	16.32
22.0	19.75
24.0	23.50
26.0	27.58
28.0	31.99
30.0	36.72
32.0	41.78



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CHLORINE ENHANCER

Use CHLORINE ENHANCER to:

- Adjust the pH of water so chlorine becomes 200 times more effective

How to use CHLORINE ENHANCER:

- Pre-mix the appropriate amount of calcium or sodium hypochlorite and water in an above-ground tank to yield a 200 ppm solution and to approximate three times the volume of water in the well. It may be necessary to make several batches. Stir until dissolved.
- Add the required amount of CHLORINE ENHANCER (see the chart) to the tank solution and stir until well-blended.
- Studies have shown that to successfully chlorinate a water well use a 200 part-per-million chlorine concentration. In order to achieve a 200 ppm concentration and to determine how much CHLORINE ENHANCER is needed, use the following table. It's very important to follow this chart because too much CHLORINE ENHANCER could lower pH values into a range that may evolve harmful gases.

Water (gallons)	Granular Calcium Hypochlorite (65% available chlorine)	Sodium Hypochlorite (household bleach) (5% available chlorine)	Sodium Hypochlorite (industrial bleach) (10% available chlorine)	Chlorine Enhancer
1	0.04 ozs.	0.13 fluid ounces	0.25 fluid ounces	0.06 ozs
125	5 ozs.	1/2 gallon	1 quart	7.5 ozs
250	10 ozs.	1 gallon	1/2 gallon	15 ozs
500	20 ozs. (1 lb 4 ozs.)	2 gallons	1 gallon	30 ozs (1 lb 14 ozs)
1000	40 ozs. (2 lbs 8 ozs.)	4 gallons	2 gallons	60 ozs (3 lbs 12 ozs)

Note: One lid full of Chlorine Enhancer (from the 10-lb container) is about 7 ounces.

- Pour the pre-mixed solution into the well.
- Leave the solution in the well for 5-7 hours. If possible circulate the solution in the well with the pump every few hours.
- After treating, the initial water contains spent chemical and should be pumped to waste. Once the well is clean, test for bacteria.

Some background information:

Sodium or calcium hypochlorite and sodium dichloroisocyanurate are the most common sources of chlorine used in our industry today. When any one of these are added to water both hypochlorous acid and hypochlorite ion are produced. Hypochlorous acid (HOCl) is much more effective against bacteria (over 200 times more effective) than the hypochlorite ion. But, the amount of HOCl produced depends on the pH of the water. Above pH 7.5 very little chlorine occurs as helpful hypochlorous acid, but rather as ineffective hypochlorite ion. To ensure good results the pH of the water should be kept between 6.0 and 7.5. If the water gets below 6.0 chlorine gas may be formed which is dangerous for workers.

CHLORINE ENHANCER is specially formulated to lower the pH of water so HOCl may be produced. By carefully following the use instructions you will receive maximum benefit from your chlorine application. Whether using calcium hypochlorite, sodium hypochlorite or sodium dichloroisocyanurate to chlorinate the well, not as much is needed, thus your equipment is safer, you are safer and you save money.

How to dispose of CHLORINE ENHANCER:

Waste testing showed that less than 50 ppm residual chlorine presents no hazard to crops whereas fish are susceptible in ranges from 0.1 to 5.0 ppm, depending on pH, dissolved oxygen, temperature and synergism/antagonism of other pollutants. Therefore, waste should not be pumped into streams and should be thoroughly diluted if pumped onto fields. Cotey Chemical recommends that waste be pumped to sewage or barrow ditches for natural evaporation, or to local pits for evaporation and then back-filling, provided filtration won't contaminate a local aquifer. In all cases waste should be thoroughly diluted. Adhere to local, state and federal regulations.

CAUTION:

Corrosive. Keep out of reach of children. May be fatal if swallowed. Do not breathe dust. Use splash goggles and rubber gloves when handling this material. Avoid contact with eyes. May produce chemical burns. Do not get in eyes, on skin or on clothing. Use in a well ventilated area. Always use proper dosage because dangerous gas could be produced if the pH of the solution is too low. Never add CHLORINE ENHANCER to concentrated chlorine (concentrated calcium or sodium hypochlorite or sodium dichloroisocyanurate).

CHLORINE ENHANCER is packaged in 10-lb and 50-lb containers.

Diameter of Casing or hole (inches)	Gallons of water per foot of depth
3.0	0.37
3.5	0.50
4.0	0.65
4.5	0.83
5.0	1.02
5.5	1.23
6.0	1.47
7.0	2.00
8.0	2.61
9.0	3.31
10.0	4.08
11.0	4.94
12.0	5.88
13.0	6.90
14.0	8.00
15.0	9.18
16.0	10.00
17.0	11.79
18.0	13.22
19.0	14.73
20.0	16.32
22.0	19.75
24.0	23.50
26.0	27.58
28.0	31.99
30.0	36.72
32.0	41.78



DRY ACID®

Use DRY ACID® to:

- Remove clays, shales, drilled “cuttings” and commercial drilling muds from water wells.
- Slip gravel and free stuck drill pipe.
- Develop new wells to their maximum specific capacity by breaking down mud-cake produced during drilling.
- Redevelop old wells producing in sand and gravel formations to their original flow or greater.

How to use DRY ACID®:

- Use 1/2 to 3/4-lb. of DRY ACID® per gallon of water. (See table)
- If a deep well turbine pump is in the hole add the DRY ACID®, about 1/4 the required amount at a time, between the pump column and casing.
- Agitate the solution in the well with a tight-fitting surge block or other isolation tool, like the COTEY WELL CLEANING BRUSH, every two to four hours for 24-36 hours. A bailer, surge-block or other tool will also work. Dry ice can be used to agitate the chemical if a rig or pump is not available. This agitation dislodges material softened by the chemical treatment and pushes the chemical solution further into areas it may otherwise not be able to reach. The combination of both chemical and mechanical methods is vital to get the best results for the water well.
- When acidizing a water well it is best to check the pH frequently. When pH levels rise above 3.0 the acid is losing strength and productivity, therefore more acid should be added. Monitoring pH in this way allows for a more accurate chemical treatment.
- Pump or bail the hole clean, develop and test. Continue pumping until the pH of the water is within 0.5 pH units of the original value before treating. The initial treated water contains spent chemical and should be pumped to waste. Repeat the above steps as necessary to achieve optimum well production.
- For additional chemical penetration use DRY ACID® with Cotey Chemical’s MUD-NOX®.

Some background information:

DRY ACID® is specifically blended to remove clays, shales, drilled cuttings and commercial drilling muds from water wells. It will effectively prevent mud-cake build-up if used during well drilling or will quickly remove mud-cake afterwards. This “mud-cake”, consisting of fine silts and clay particles, is often partially cemented or consists of minute calcium carbonate fragments. Standard treatments using acid may aggravate rather than correct the problem. The acid-dissolving cations present in the clay allow free silicone dioxide (Silica, SiO₂) to precipitate out as a gel instead of dissolving it. DRY ACID® not only dissolves the “mud-cake” but acts as a strong sequestering agent preventing silt and clay particles from precipitating or flocculating out of solution. DRY ACID® may even be used to redevelop older wells produced in sand and/or gravel formations to their original flow or greater. DRY ACID® is safe on plastics, rubber and metals commonly used in water well equipment. It will not harm the pump or well screen.

How to dispose of DRY ACID®:

Waste resulting from treatment with DRY ACID® may cause increased levels of sodium and bisulfate ions. Therefore, waste should not be pumped onto cultivated fields nor made available to livestock and should not be pumped into streams or onto soil unless considerably diluted. Cotey Chemical recommends that waste be pumped to sewage or barrow ditches for natural evaporation, or to local pits for evaporation and then back-filling, provided filtration won't contaminate a local aquifer. In all cases waste should be thoroughly diluted. Adhere to local, state and federal regulations.

CAUTION:

DO NOT MIX DRY ACID® WITH OTHER CHEMICALS!

When using this product, wear eye goggles or safety glasses. DRY ACID® is primarily an acid, therefore avoid breathing the dust. Wash with water after handling. If ingested, drink large quantities of tea, coffee, water or milk with raw eggs if available. Secure medical aid as quickly as possible.

DRY ACID® is packaged in 10-lbs., 50-lbs., and 600-lbs. containers.

Diameter of Casing or hole (inches)	Gallons of water per foot of depth
3.0	0.37
3.5	0.50
4.0	0.65
4.5	0.83
5.0	1.02
5.5	1.23
6.0	1.47
7.0	2.00
8.0	2.61
9.0	3.31
10.0	4.08
11.0	4.94
12.0	5.88
13.0	6.90
14.0	8.00
15.0	9.18
16.0	10.00
17.0	11.79
18.0	13.22
19.0	14.73
20.0	16.32
22.0	19.75
24.0	23.50
26.0	27.58
28.0	31.99
30.0	36.72
32.0	41.78



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DRY ACID® SPECIAL

Use DRY ACID® SPECIAL to:

- Dissolve limestone, hard-water scale, rust and corrosion deposits
- Develop new wells producing from limestone or calcareous sand and gravel formations.
- Redevelop old wells that have hard-water scale, rust or corrosion deposits plugging the perforations, screen or formation.

How to use DRY ACID® SPECIAL:

- Use $\frac{3}{4}$ to 1 lb. of DRY ACID® SPECIAL per gallon of water in the well. (See table)
- If a deep well turbine pump is in the hole add about 1/4 the required amount of DRY ACID® SPECIAL in between the pump column and casing. Agitate by backwashing after each addition of acid. If a rig is over the hole, add the acid inside the casing and agitate with a bailer, surge block or other tool.
- Agitate the solution in the well with a tight-fitting surge block or other isolation tool, like the COTEY WELL CLEANING BRUSH, every two to four hours for 24-36 hours. A bailer, surge-block or other tool will also work. Dry ice can be used to agitate the chemical if a rig or pump is not available. This agitation dislodges material softened by the chemical treatment and pushes the chemical solution further into areas it may otherwise not be able to reach. The combination of both chemical and mechanical methods is vital to get the best results for the water well.
- When acidizing a water well it is best to check the pH frequently. When pH levels rise above 3.0 the acid is losing strength and productivity, therefore more acid should be added. Monitoring pH in this way allows for a more accurate chemical treatment.
- Pump or bail the hole clean, develop and test. Continue pumping until the pH of the water is within 0.5 pH units of the original value before treating. The initial treated water contains spent chemical and should be pumped to waste. Repeat the above steps as necessary to achieve optimum well production.

Some background information:

DRY ACID® SPECIAL is a non-toxic, non-explosive and non-fuming granular product. It can be slowly and safely added to a water well without special training or special holding tanks and hoses. The slower reaction rate of DRY ACID® SPECIAL reduces the possibility of a “blowout”. Moreover, this slower reaction allows DRY ACID® SPECIAL to be pushed further into the water-bearing formation than HCl (muriatic acid), exposing it to more clogged surfaces. Also, because it’s a granular product, no emergency exists if a spill does occur.

DRY ACID® SPECIAL also has a blend of polymers that are designed to suspend large amounts of calcium, magnesium, and iron minerals that are released as the acid dissolves deposits. This allows more material to be removed when pumping the spent chemicals to waste. The result is a better, more complete well rehabilitation.

How to dispose of DRY ACID® SPECIAL:

Waste resulting from treatment with DRY ACID® SPECIAL should not be pumped onto cultivated fields nor made available to livestock and should not be pumped into streams or onto soil unless considerably diluted. Cotey Chemical recommends that waste be pumped to sewage or barrow ditches for natural evaporation, or to local pits for evaporation and then back-filling, provided filtration won't contaminate a local aquifer. In all cases waste should be thoroughly diluted. Adhere to local, state and federal regulations.

CAUTION:

DO NOT MIX DRY ACID® SPECIAL WITH OTHER CHEMICALS!

When using this product, wear eye goggles or safety glasses. DRY ACID® SPECIAL is primarily an acid, therefore avoid breathing the dust. Wash with water after handling. If ingested, drink large quantities of tea, coffee, water or milk with raw eggs if available. Secure medical aid as quickly as possible. Dry Acid Special is packaged in 10-lb, 50-lb and 600-lb containers.

Store DRY ACID® SPECIAL away from chlorine. Do not add chlorine or liquid bleach to wells treated with DRY ACID® SPECIAL until the well has been pumped to waste. Under acidic conditions, pH below 7.0, chlorine added to DRY ACID® SPECIAL may form nitrogen trichloride (NCl₃), an explosive.

DRY ACID® SPECIAL is packaged in 10-lbs., 50-lbs., and 600-lbs. containers.

Diameter of Casing or hole (inches)	Gallons of water per foot of depth
3.0	0.37
3.5	0.50
4.0	0.65
4.5	0.83
5.0	1.02
5.5	1.23
6.0	1.47
7.0	2.00
8.0	2.61
9.0	3.31
10.0	4.08
11.0	4.94
12.0	5.88
13.0	6.90
14.0	8.00
15.0	9.18
16.0	10.00
17.0	11.79
18.0	13.22
19.0	14.73
20.0	16.32
22.0	19.75
24.0	23.50
26.0	27.58
28.0	31.99
30.0	36.72
32.0	41.78



LIQUID DESCALER

Use LIQUID DESCALER to:

- remove biofilm produced by slime-forming bacteria, such as that produced by iron-oxidizing and sulfate-reducing bacteria.
- act as an excellent chelating agent (tie up) on iron sulfates and iron chlorides.
- dissolve carbonate, sulfate, magnesium and iron deposits (mineral deposits).
- keep dissolved solids in suspension more efficiently than other mineral acids improving well rinse-out.
- descale shop equipment corroded with various mineral scales.

How to use LIQUID DESCALER:

- Descale equipment in water wells by using to 5 to 10 gallons of LIQUID DESCALER per 100 gallons of water inside the casing. (See table)
- Agitate the solution in the well with a tight-fitting surge block or other isolation tool, like the COTEY WELL CLEANING BRUSH, every two to four hours for 24-36 hours. A bailer, surge-block or other tool will also work. Dry ice can be used to agitate the chemical if a rig or pump is not available. This agitation dislodges material softened by the chemical treatment and pushes the chemical solution further into areas it may otherwise not be able to reach. The combination of both chemical and mechanical methods is vital to get the best results for the water well.
- When acidizing a water well it is best to check the pH frequently. When pH levels rise above 3.0 the acid is losing strength and productivity, therefore more acid should be added. Monitoring pH in this way allows for a more accurate chemical treatment.
- Pump or bail the hole clean, develop and test. Continue pumping until the pH of the water is within 0.5 pH units of the original value before treating. The initial treated water contains spent chemical and should be pumped to waste. Repeat the above steps as necessary to achieve optimum well production.

Some background information:

Liquid Descaler is a potent combination of acids, surfactants, inhibitors and dispersants. It dissolves mineral scales and then keeps them in solution to be flushed to waste. One of the main chemicals used in LIQUID DESCALER is hydrochloric acid (HCl). HCl is a very effective mineral acid capable of dissolving a variety of hard water scale in a minimum amount of time. Because it's so strong we've added an excellent inhibitor to protect the casing and screen from being damaged. LIQUID DESCALER also works to dissolve slime and other biofouling issues caused by various kinds of bacteria including slime-forming, sulfate-reducing, and iron/manganese oxidizing bacteria. It is safe on all common metals in well equipment except for prolonged contact with aluminum or galvanized equipment. Use DRY ACID® SPECIAL with BIOCLEAN for descaling and/or removing slime from aluminum or galvanized equipment.

How to dispose of LIQUID DESCALER:

Waste resulting from treatment with LIQUID DESCALER contains a surface-active agent and, depending on how much LIQUID DESCALER was used and the condition of the well treated, may be near neutral to very acidic. Therefore, waste should not be pumped onto cultivated fields nor made available to livestock and should not be pumped into streams or onto soil unless considerably

diluted. Cotey Chemical recommends that waste be pumped to sewage or barrow ditches for natural evaporation, or to local pits for evaporation and then back-filling, provided filtration won't contaminate a local aquifer. In all cases waste should be thoroughly diluted. Adhere to local, state and federal regulations.

CAUTION:

DO NOT MIX LIQUID DESCALER WITH OTHER CHEMICALS!

When using this product, wear eye goggles or safety glasses.

LIQUID DESCALER is a blend of liquid acids, polymers, surfactants and inhibitors, therefore avoid breathing the spray or mist. Wash with water after handling. If ingested, drink large quantities of tea, coffee, water or milk with raw eggs if available.

Secure medical aid as quickly as possible.

LIQUID DESCALER is packaged in 5-gallon, 55-gallon and 275-gallon containers.

Diameter of Casing or hole (inches)	Gallons of water per foot of depth
3.0	0.37
3.5	0.50
4.0	0.65
4.5	0.83
5.0	1.02
5.5	1.23
6.0	1.47
7.0	2.00
8.0	2.61
9.0	3.31
10.0	4.08
11.0	4.94
12.0	5.88
13.0	6.90
14.0	8.00
15.0	9.18
16.0	10.00
17.0	11.79
18.0	13.22
19.0	14.73
20.0	16.32
22.0	19.75
24.0	23.50
26.0	27.58
28.0	31.99
30.0	36.72
32.0	41.78



Certified to NSF/ANSI/CAN 60

MUD-NOX®

Use MUD-NOX® to:

- “wet out” and disperse mud during bailing.
- add to drilling mud to reduce solids build-up, balling of drilled clay-shale, decrease friction, and aid in reducing solids suspension.
- slip gravel.
- decrease surface tension of water when using any chemical treatment.
- remove and emulsify oil in wells with oil-lubricated turbine pumps, or for shop degreasing.
- remove “mud-cake”, silt and clay from water wells.

How to use MUD-NOX®:

- Use approximately 1 gallon/200-400 gallons of water for mud problems, and slipping gravel.
- Use approximately 1 gallon/400-600 gallons of water to penetrate and emulsify.
- Use approximately 1 gallon/400-800 gallons of fluid as a drilling mud additive.
- Add directly to water in a system being treated. (See table)
- Agitate the solution in the well with a tight-fitting surge block or other isolation tool, like the COTEY WELL CLEANING BRUSH, every two to four hours for 24-36 hours. A bailer, surge-block or other tool will also work. Dry ice can be used to agitate the chemical if a rig or pump is not available. This agitation dislodges material softened by the chemical treatment and pushes the chemical solution further into areas it may otherwise not be able to reach. The combination of both chemical and mechanical methods is vital to get the best results for the water well.
- Pump or bail the hole clean, develop and test. The initial water treated water contains spent chemical and should be pumped to waste.

Some background information:

MUD-NOX® is a superior wetting agent and emulsifier that disperses silts and clays, allowing the particles to be pumped to waste instead of collecting in the well. The emulsification properties ensure that any oil in the well will mix with the water to be pumped to waste. MUD-NOX® also disperses mud during the bailing process and may be used as a drilling additive to reduce solids build-up, decrease friction, aid in suspending solids and help remove mud-cake, silt, and clay from the well during the drilling process. As a multi-purpose surfactant/polymer with a broad range of useful applications, MUD-NOX® is an excellent addition to Cotey’s DRY ACID®, WELGICIDE CLEANER® or DRY ACID® SPECIAL for getting all the water possible from the drilled well.

How to dispose of MUD-NOX®:

Waste resulting from treatment with MUD-NOX® should not be pumped where contamination of domestic water supplies could result. Surface activity agents disturb the water-holding ability of soil, thus waste should not be pumped to cultivated fields. Stock and aquatic life are susceptible to

concentrated amounts of surface active agents, thus waste should be greatly diluted if left on the surface. Cotey Chemical recommends that waste be pumped to sewage or barrow ditches for natural evaporation, or to local pits for evaporation and then back-filling, provided filtration won't contaminate a local aquifer. In all cases waste should be thoroughly diluted. Adhere to local, state and federal regulations.

CAUTION:

MUD-NOX® is a concentrated detergent, therefore do not take internally. If swallowed, do not induce vomiting, call a physician. Keep out of eyes. For eyes, flush with fresh water and secure immediate medical attention.

MUD-NOX® is packaged in 1-gallon, 5-gallon, 55-gallon, and 275-gallon containers.

Diameter of Casing or hole (inches)	Gallons of water per foot of depth
3.0	0.37
3.5	0.50
4.0	0.65
4.5	0.83
5.0	1.02
5.5	1.23
6.0	1.47
7.0	2.00
8.0	2.61
9.0	3.31
10.0	4.08
11.0	4.94
12.0	5.88
13.0	6.90
14.0	8.00
15.0	9.18
16.0	10.00
17.0	11.79
18.0	13.22
19.0	14.73
20.0	16.32
22.0	19.75
24.0	23.50
26.0	27.58
28.0	31.99
30.0	36.72
32.0	41.78



WEL-CHLOR PLUS

The “New” Chlorine

Use WEL-CHLOR PLUS to:

- Purify the water in new and old water wells and systems.
- Dissolves 5x faster than calcium hypochlorite
- Superior shelf life
- Remove nitrates, iron, sulfites (not sulfates), and manganese
- Treat algae, fungi and bacteria (including slime-forming, iron, and sulfate-reducing bacteria)
- NSF certified

How to use WEL-CHLOR PLUS:

- For best results, clean the well both mechanically and chemically prior to the WEL-CHLOR PLUS treatment. Brush the well with Cotey’s WELL CLEANING BRUSH. This allows WEL-CHLOR PLUS to have more uniform access into the formation.
- To achieve a 200 ppm chlorine solution add about 5 ounces of WEL-CHLOR PLUS per 100 gallons of water in the mixing tank and allow it to dissolve. It may be necessary to make several small batches.
- Add the solution through the water-level access hole or other opening between the casing and column pipe, or through the discharge.
- Agitate the solution in the well every few hours for eight hours. This helps ensure even mixing, helps treat more of the well, and pushes the chemical further into the formation.
- Pump or bail the hole clean. After treatment, the initial water contains residual chemical and should be thoroughly diluted and pumped to waste.
- To disinfect equipment, use about one ounce of WEL-CHLOR PLUS per 25 gallons of water. Allow the equipment to soak in the solution for one hour. Thoroughly dilute waste and dispose of properly.

Some background information:

The accumulation of nuisance organisms such as fungi, algae, molds and various bacteria is a real problem in some areas. Generally speaking, this problem is best solved by preventive treatments rather than waiting until the well is plugged. Usually these organisms can be controlled if the water well is sterilized with some accepted method when it is first completed and then treated periodically. The standard method for treating water supplies for bacterial pollution is by chlorination. Chlorination is adding chlorine to water. There are 4 forms of disinfecting chlorine: chlorine gas, sodium hypochlorite (liquid bleach), calcium hypochlorite, and sodium dichloroisocyanurate. Cotey Chemical has chosen sodium dichloroisocyanurate as the base chemistry for our WEL-CHLOR PLUS. While the other chlorine options have certain benefits, Cotey believes this chlorine product is unsurpassed. It is very easy and safe to use, is relatively inexpensive, dissolves up to five times faster than calcium hypochlorite and is extremely stable. This stability is what makes it so beneficial: WEL-CHLOR PLUS off-gasses more slowly making it safer to handle and giving it a longer shelf life. In water wells it has a slow release of relatively low chlorine concentrations at a constant rate resulting in longer residual action and a longer disinfecting time. It also completely decomposes leaving the well water clear and pristine.

How to dispose of WEL-CHLOR *PLUS* :

Waste testing < 50 ppm of residual chlorine presents no hazard to crops whereas the susceptibility of fish ranges from 0.1 to 5.0 ppm, depending on pH, dissolved oxygen, temperature and synergism/antagonism of other pollutants. Well waste, after treatment should therefore not be pumped into streams and, if pumped onto fields, should be checked for chlorine concentration or thoroughly diluted. Cotey Chemical recommends that waste be pumped to sewage or barrow ditches for natural evaporation, or to local pits for evaporation and then back-filling, provided filtration won't contaminate a local aquifer. In all cases waste should be thoroughly diluted. Adhere to local, state and federal regulations.

CAUTION:

Do not mix WEL-CHLOR *PLUS* with other chemicals. Do not mix this product with calcium hypochlorite or HTH. Add WEL-CHLOR *PLUS* to a large quantity of water. Never add water to WEL-CHLOR *PLUS*. When using WEL-CHLOR *PLUS*, wear safety goggles or safety glasses. WEL-CHLOR *PLUS* is a strong oxidizer. If contact occurs, skin or eyes should be flushed with water and medical attention secured. If ingested, drink large amounts of liquid such as water. Seek immediate medical aid. Do not induce vomiting.

WEL-CHLOR *PLUS* is packaged in 9-lb, 48-lb and 300-lb containers.

Diameter of Casing or hole (inches)	Gallons of water per foot of depth
3.0	0.37
3.5	0.50
4.0	0.65
4.5	0.83
5.0	1.02
5.5	1.23
6.0	1.47
7.0	2.00
8.0	2.61
9.0	3.31
10.0	4.08
11.0	4.94
12.0	5.88
13.0	6.90
14.0	8.00
15.0	9.18
16.0	10.00
17.0	11.79
18.0	13.22
19.0	14.73
20.0	16.32
22.0	19.75
24.0	23.50
26.0	27.58
28.0	31.99
30.0	36.72
32.0	41.78



WELGICIDE CLEANER®

Use WELGICIDE CLEANER® to:

- remove bacterial slimes, iron oxides, iron bacteria, sulphur and sulfate-reducing bacteria.
- emulsify oil which has entered the well due to oil-lubricated pumps or accidental spilling.
- Treat algae, vegetation or animals which have inadvertently fallen into the well.
- remove organic material from wells, plumbing, wash basins, sewer lines, and toilets.

How to use WELGICIDE CLEANER®:

- If possible, brush the well with the COTEY WELL CLEANING BRUSH before chemical treatment. Brushing the well can remove interior screen deposits. This ensures more uniform chemical access into the formation. Other common mechanical cleaning methods include swabbing and jetting. Then bail the debris from the bottom of the well.
- Use about 1/4-lb. of WELGICIDE CLEANER® per gallon of water inside the casing. (see table)
- Pour in dry between casing and column pipe. Backwash well to mix and distribute the chemical inside the column pipe. Add WELGICIDE CLEANER® carefully to the water as considerable heat will be generated when it is dissolved in water.
- Agitate the solution in the well with a tight-fitting surge block or other isolation tool, like the COTEY WELL CLEANING BRUSH, every two to four hours for 24-36 hours. A bailer, surge block or other tool will also work. Dry ice can be used to agitate the chemical if a rig or pump is not available. Agitation dislodges material softened by the chemical treatment and pushes the chemical solution further into areas it may otherwise not be able to reach. The combination of both chemical and mechanical methods is vital to get the best results for the water well.
- Pump or bail the hole clean, develop and test. Continue pumping until the pH of the water is within 0.5 pH units of the original value before treating. The initial treated water contains spent chemical and should be pumped to waste. Repeat the above steps as necessary to achieve optimum well production.
- For additional chemical penetration and/or to remove “mud-cake”, silt, and clay also in the well use WELGICIDE CLEANER® with Cotey Chemical’s MUD-NOX®. Do not use WELGICIDE CLEANER® on aluminum, magnesium or galvanized pipes.

Some background information:

WELGICIDE CLEANER® is a highly alkaline chemical blend with detergency, sequestering, deflocculating and buffering properties. As such, WELGICIDE CLEANER® is one of the most versatile and effective chemical treatments offered by Cotey Chemical.

How to dispose of WELGICIDE CLEANER®:

Waste resulting from treatment with WELGICIDE CLEANER® is very alkaline, (has a high pH) and

should therefore not be allowed to contaminate the domestic water supply. Although phosphates are often beneficial to crops, the attendant alkalinity is locally detrimental to the soil, thus waste should not be pumped to cultivated fields unless greatly diluted. Phosphates are also beneficial to fish, but detrimental to lakes and ponds in that they stimulate algae growth. Cotey Chemical recommends that waste be pumped to sewage or barrow ditches for natural evaporation, or to local pits for evaporation and then back-filling, provided filtration won't contaminate a local aquifer. In all cases waste should be thoroughly diluted. Adhere to local, state and federal regulations.

CAUTION:

DO NOT MIX WELGICIDE CLEANER® WITH OTHER CHEMICALS!

When using this product, wear eye goggles or safety glasses. WELGICIDE CLEANER® is a very strong alkali, therefore always use goggles or safety glasses, do not take internally and keep from skin contact. Do not breathe fine dust. If Skin and/or eye contact occurs, flush with water and get medical attention immediately. If ingested, drink large quantities of tea, coffee, or milk with raw eggs if available.

WELGICIDE CLEANER® is packaged in 50-lbs. and 550-lbs. containers.

Diameter of Casing or hole (inches)	Gallons of water per foot of depth
3.0	0.37
3.5	0.50
4.0	0.65
4.5	0.83
5.0	1.02
5.5	1.23
6.0	1.47
7.0	2.00
8.0	2.61
9.0	3.31
10.0	4.08
11.0	4.94
12.0	5.88
13.0	6.90
14.0	8.00
15.0	9.18
16.0	10.00
17.0	11.79
18.0	13.22
19.0	14.73
20.0	16.32
22.0	19.75
24.0	23.50
26.0	27.58
28.0	31.99
30.0	36.72
32.0	41.78



Certified to NSF/ANSI/CAN 60

WELL CONDITIONER

Use WELL CONDITIONER to:

- Protect a dormant water well
- Reduce corrosion
- Extend the life of the well and the pump
- Prevent scale formation
- Control biofouling and odor by reducing the ability for any bacterial slimes to attach to treated surfaces

How to use WELL CONDITIONER:

- Add 4 gallons of WELL CONDITIONER per 100 gallons of water in the well (see table).
- Add the WELL CONDITIONER through the water-level access hole or other opening between the casing and the column pipe, or through the discharge.
- There is no need to pull the pump. The more dense WELL CONDITIONER will disperse throughout the water column, coating the metal and mineral surfaces with a protective molecular barrier.

Some background information:

A dormant water well is a highly corrosive environment. The water column provides a mechanism for transporting oxygen to metal surfaces. This accelerates the process of corrosion and it's this corrosion that provides a food source for bacteria. Multiplying bacteria often lead to biofouling, the impairment or degradation of underwater surfaces or equipment as a result of living organisms. Whether in an active or dormant water well the bacteria accumulation can result in clogging, contamination, and damage to equipment. Moreover, buildup of the corrosion itself also may clog water pathways and cause damage to equipment. WELL CONDITIONER is a new technology designed to protect the metal and mineral surfaces in a dormant water well from corrosion.

How to dispose of WELL CONDITIONER:

Waste resulting from treatment with WELL CONDITIONER may be alkaline, (has a high pH). Therefore, waste should not be pumped onto cultivated fields nor made available to livestock and should not be pumped into streams or onto soil unless considerably diluted. Cotey Chemical recommends that waste be pumped to sewage or barrow ditches for natural evaporation, or to local pits for evaporation and then back-filling, provided filtration won't contaminate a local aquifer. Adhere to local, state and federal regulations.

CAUTION:

When using WELL CONDITIONER, wear chemical resistant gloves and eye goggles. Do not mix with other chemicals. Do not change containers.

WELL CONDITIONER is packaged in 5-gallon and 55-gallon containers.

Diameter of Casing or hole (inches)	Gallons of water per foot of depth
3.0	0.37
3.5	0.50
4.0	0.65
4.5	0.83
5.0	1.02
5.5	1.23
6.0	1.47
7.0	2.00
8.0	2.61
9.0	3.31
10.0	4.08
11.0	4.94
12.0	5.88
13.0	6.90
14.0	8.00
15.0	9.18
16.0	10.00
17.0	11.79
18.0	13.22
19.0	14.73
20.0	16.32
22.0	19.75
24.0	23.50
26.0	27.58
28.0	31.99
30.0	36.72
32.0	41.78



Certified to NSF/ANSI/CAN 60

COTEY TEST KIT

Having problems with your water well but don't know where to begin? Cotey Chemical has your answer: The Cotey Test Kit.

With the Cotey Test Kit you will receive:

- A complete well water analysis, or
- A complete well scale analysis
- An interpretation of the probable issues involving your water well
- A full water well rehabilitation recommendation

All for one low price!

There are two categories of testing that we use to classify well plugging issues:

1) WATER ANALYSIS

Inorganic Chemistries: pH, alkalinity, bicarbonate, carbonate, chloride, total dissolved solids, conductivity, total hardness, calcium, magnesium, copper, iron, manganese, phosphate, nitrate, silica, sulfate, tannin/lignin, potassium, sodium, chlorine, oxidation-reduction potential (ORP), total organic carbon (TOC), saturation index

Bacterial assessment: Heterotrophic plate count (HPC), sulfate reducing bacteria (SRB), iron precipitating bacteria (IPB), slime forming bacteria (SLYM)



2) SCALE ANALYSIS

The scale sample is digested with acid and is analyzed with spectrophotometric, turbidimetric, and/or titrimetric methods for final analysis.

These scientific parameters are tested for by standard methods so that the complete chemical layout of the well can be understood.

Other information is also gathered such as formation identification, well history, well specifications, well use, and well construction. After gathering all this information Cotey Chemical can then recommend a well rehabilitation procedure tailored to the exact goals of the project.

When the final lab report is given to the customer it includes a complete well rehabilitation procedure, chemical volumes necessary for the rehab, and results with interpretations of the water and/or scale lab test.



COTEY WELL CLEANING BRUSH

(Patent No. US7,121,336 B2)

- All purpose brush for cleaning all types of casing and screen including PVC!
- Unique design - agitates, surges and scrubs simultaneously!
- Self cleaning - scale particles flush out of the brush!
- Versatile! Attaches to cable or pipe.
- Floating brush design ensures free movement, which virtually eliminates binding or “hanging up” inside the casing!
- Interchangeable brush design allows you to select the brush size to match the casing to be brushed!
- Durable! Will not wear out as quickly and holds its shape better than conventional steel-bristled brushes. Heavy-duty bristles are made of the highest quality polypropylene.

For best results use with Cotey’s well cleaning chemicals



**Special order
brush sizes available**

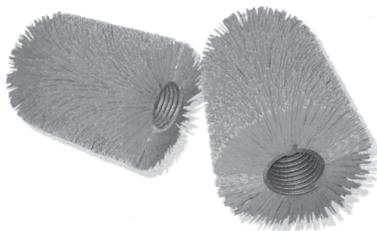


J200 Model:

- Designed to use four interchangeable brushes to clean 4, 4 1/2, 5, 6 and 8-inch casing
- 2-inch pipe threaded bail with 5/8-inch shackle allows it to be run on cable
- 2-inch pipe thread allows it to be run on 2-inch pipe
- 48 inches long allows it to be shipped on a typical pallet
- Weighs 45 pounds

J400 Model:

- Designed to use two interchangeable brushes to clean 8, 10, 12, 14, 16, 18, 20, 22 and 24-inch casing.
- 4-inch pipe thread bail with 3/4-inch shackle allows it to be run on cable
- 4-inch pipe thread allows it to be run on 4-inch pipe
- 48 inches long allows it to be shipped on a typical pallet
- Weighs 165 pounds



**Special order
brush size available**

Made in the USA

Quick Reference Table

Problem	Recommended Product	Treatment Time
Algae	WELGICIDE CLEANER®	24 hours
Animals in the well	WELGICIDE CLEANER®	24 hours
Bacterial "Slime"		
- Hard water areas	LIQUID DESCALER	24 hours
- Hard water areas with galvanized parts	DRY ACID® SPECIAL & BIOCLEAN	24 hours
- Soft water areas	WELGICIDE CLEANER®	24 hours
- Soft water areas with galvanized parts	DRY ACID® SPECIAL & BIOCLEAN	24 hours
Calcium Carbonate scale (calcite)		
- Wells with galvanized parts	DRY ACID® SPECIAL	24 hours
- Wells without galvanized parts	LIQUID DESCALER	24 hours
Calcium Sulfate scale (gypsum)	LIQUID DESCALER	48-72 hours
Coliform bacteria, free-swimming in the water	WEL-CHLOR PLUS	8-12 hours
- Encapsulated in slime	LIQUID DESCALER	24 hours
- Encapsulated in slime with galvanized parts	DRY ACID® SPECIAL & BIOCLEAN	24 hours
Drilling Mud	DRY ACID® OR MUDNOX®	24 hours
Iron Bacteria, free-swimming in the water	WEL-CHLOR PLUS	12 hours
- Encapsulated in slime with galvanized parts	DRY ACID® SPECIAL & BIOCLEAN	24 hours
- Encapsulated in slime without galvanized parts	LIQUID DESCALER	24 hours
Iron Scale (iron oxide)		
- Well with galvanized parts	DRY ACID® SPECIAL & BIOCLEAN	30 hours
- Well without galvanized parts	LIQUID DESCALER	30 hours
Mud-cake	DRY ACID® OR MUDNOX®	24 hours
Oil film (drip oil from oil-lubricated turbine pump)	MUD-NOX®	12 hours
Oil slime (bacteria "feeding off" drip oil)	WELGICIDE CLEANER®	24 hours
Old, inactive well		
- Hard water area without bacterial slime with galvanized parts	DRY ACID® SPECIAL	24 hours
- Hard water area with bacterial slime without galvanized parts	LIQUID DESCALER	24 hours
- Hard water area with bacterial slime with galvanized parts	DRY ACID® SPECIAL & BIOCLEAN	24 hours
- Soft water area with bacterial slime without galvanized parts	WELGICIDE CLEANER®	24 hours
Rust & Corrosion deposits		
- Well with galvanized parts	DRY ACID® SPECIAL	24 hours
- Well without galvanized parts	LIQUID DESCALER	24 hours
Silting of well	DRY ACID®	24 hours
Sterilizing well	WEL-CHLOR PLUS	8-12 hours
Sulfate-reducing bacteria		
- Well with galvanized parts	DRY ACID® SPECIAL & BIOCLEAN	24 hours
- Well without galvanized parts	LIQUID DESCALER	24 hours
Vegetation in the well (i.e. small "hairy" tree roots)	WELGICIDE CLEANER®	24-36 hours



4410 MLK Jr. Blvd.
P.O. Box 2039
Lubbock, Texas 79408
800.457.2096
806.747.2096
806.747.7138 fax
www.coteychemical.com