



# Matrix Acidizing 101

## The History, Process & Safety Behind a Widely-Used Technique

### Background & History

Matrix Acidizing is a widely-accepted technique that has safely and successfully been used to improve well productivity for nearly 120 years. Matrix Acidizing like many technical terms, once you understand the history and science behind it, makes sense and has been proven to be safe if done correctly.

The “Matrix” in Matrix Acidizing refers to the limestone matrix that is part of Southwest Florida’s geology. Limestone is rock made of calcium carbonate, and, if you remember some basic chemistry, it will slowly dissolve if acid is added to it. Matrix Acidizing, which is used to improve well productivity by dissolving a small amount of limestone to allow larger pores through which oil can move to an oil well, predates all other well stimulation techniques, including hydraulic fracturing. The technique of Matrix Acidizing has been used by the onshore oil and gas industry for nearly 120 years, but became more prevalent in the 1930s once acid corrosion inhibitors were developed to protect the steel casings in wells. Today, acidizing is one of the most widely used and effective means available to improve well productivity.

Importantly, it is not just the oil and gas industry that has been utilizing Matrix Acidizing – counties and municipalities have also historically used this technique, and still do today, in order to rehabilitate potable water supply wells. By dissolving a little bit of limestone in the pores surrounding potable supply wells, counties and municipalities can get more water from the ground to serve to the public – just like matrix acidizing is used to get more oil from an oil well. The reason that this process can be used for drinking water is that the acid is quickly used up in the reaction with the limestone – yielding a small amount of salty water (remembering basic chemistry, mixing an acid and a base – limestone – yields salt). In fact, in Southwest Florida, many potable water utilities routinely perform acidification on their production wells, including Bonita Springs Utilities, Island Water Association, Collier County Utilities, Lee County Utilities, Cape Coral Utilities, City of Fort Myers, Gasparilla Island Water Association and the City of Naples.

The fact is most industrial processes use chemicals, like those used during the Matrix Acidizing process; and, these chemicals do have the potential to be harmful if used in significant quantities and if they are not handled properly. For example, prior to injection, the Matrix Acidizing fluid has a low pH, but after usage the pH returns to the background pH of near 7 (or neutral). As noted above, chemicals even go into our drinking water supplies – for example, drinking water treatment plants commonly use large quantities of hypochlorite. While this may sound unsafe, if handled properly, the hypochlorite ensures a community is supplied with clean, safe drinking water, and poses minimal risk to plant workers or nearby residents as compared to the benefit in reducing the spread of disease.

Similar to water treatment plants, the onshore oil and gas industry uses chemicals when performing Matrix Acidizing (that is, an acid mixture used to dissolve a small amount of limestone to improve flow to a well), which has been found to be equally as safe when properly handled and operators utilize best industry practices. Overall, these common chemicals that are encountered in our everyday lives are widely used and safe when handled properly.

### The Process

The process of Matrix Acidizing involves injecting acid and chemical additives into a wellbore or geologic formation that is capable of producing oil or gas. The injected acid then dissolves limestone and other materials that is restricting flow of oil to the oil well and, in turn, enhances or creates new flow paths to the wellbore.

The type of acid injected into limestone formations, which is what forms the hydrocarbon reservoirs in Florida, is hydrochloric acid, commonly called muriatic acid, which is put into swimming pools to maintain the pH.

Acetic acid is also sometimes used. Acetic acid is another name for vinegar. Once the acid is injected, it is naturally neutralized by dissolving carbonate minerals within the formation and the end products are nothing more than water, and a small amount of carbon dioxide, gas and salt.

In fact, this is the same science experiment we all saw in our high school science class where the teacher poured vinegar (acetic acid) over baking soda (akin to limestone) - it bubbled up (carbon dioxide), neutralized itself and the chemical reaction ended. The reaction was fast and complete, leaving a little salt water at near neutral pH.

## **Safety**

Matrix Acidizing does not pose a threat to the environment or Florida's groundwater supplies, as any acid that is accidentally spilled will be neutralized by calcium carbonate in the soil and in the aquifer formation. In addition, as an indication of just how safe Matrix Acidizing is, counties and municipalities are injecting the same muriatic acid, sometimes at much higher concentrations, directly into wells used for drinking water supplies and, in some instances, with corrosion inhibitors. Overall, the technique has long been safely used on onshore oil and gas wells, as well as potable water supply wells, and would clearly not pose a threat when applied more than 2 miles below land surface (as compared to directly into the drinking water well).

## **Bottom Line**

Matrix Acidizing is a widely-accepted technique that has safely and successfully been used to improve well productivity for nearly 120 years and has been proven to be an environmentally-sensitive technique that does not pose a threat to Florida's groundwater resources or the public health and welfare.

While some may seek to raise the alarm either because they do not understand the well-known science behind it or are intentionally misleading the public, this is a long-used technique that is supported by easily verifiable science.

## Example of Chemical List from a Florida Matrix Acidizing Plan

Chemical (Main ingredients)	Trade or common name	Use	Other uses
Hydrochloric acid (HCl)	Muriatic acid	Acid	Stomach acid, calcium scale remover, pool chemical
Hydrochloric acid and organic acids	Supersol EQH-105	Acid	
Acetic acid (CH <sub>3</sub> COOH)		Acid	Vinegar
Isopropyl alcohol	LT-32	Surfactant	Disinfectant
Acrylamide modified polymer Petroleum distillates Ammonium chloride Oxyalkylated alcohol	Agicel 11	Gelling agent	
Citric acid	Ferrotrol 111	Iron control	Food and soft drink additive
Trisodium nitrilotriacetate monohydrate	Ferrotrol 80L	Iron control	Chelating agent

Aromatic aldehyde Isopropanol Oxyalkylated fatty acids Quaternary ammonium compound Formic acid	C-31	Corrosion inhibitor	
Oxylated alcohol	NE-945	Non-emulsifier	Household detergents
Benzoic acid	Benzoic acid	Divertor	Food preservative
Claycare – Clay Treat 2C, 260	Choline chloride	Clay stabilization	Ingredient in pet foods – a vitamin
2-Butoxyethanol	US 40	Solvent	Solvent for <u>paints</u> and surface coatings, cleaning products, and <u>inks</u>
Guar gum	GW-38LF	Gelling agent	Food ingredient
Citrus terpenes hydrocarbon	Paravan 28	“Green” solvent	Natural citrus cleaner