

## Scientific background on electromagnetic water treatment

Electromagnetic or magnetic water treatments are quite well-known in the field of scaling prevention for buildings but the mechanisms of such treatments are not well documented. There are only few international publications in relation to this subject.

To be brief, Kobe et al. (2001, 2003) found experimentally that magnetic field enhances the formation of aragonite in the early nano-nucleation stages of crystallization of CaCO<sub>3</sub> in water flow system, reducing thus scaling. Gabrielli et al. (2000) proved that magnetic treatment of scaling waters is efficient with a maximum efficiency at an optimal flow of the water to treat. They proposed a hypothesis for the possible mechanisms of antiscaling action of the magnetic field. Alimi et al. (2009) proved that a magnetic water treatment affects calcium carbonate crystallization by increasing the total precipitate amount and by favouring its formation in the bulk solution instead of its incrustation on the walls. Lucyna Holysz et al. (2003) postulated that the magnetic field effect, among other reasons, is due to changes in the hydration shell of the ions (with changes in the zeta potential). Unfortunately, the efficiency of the magnetic treatment depends on the flow rate, the chemical composition of water, the pipe material used, and the nature of biofilms and scaling etc.

Using an EM treatment makes it able to remain efficient whatever the conditions, concepts can be set up, to avoid the influence of flow rate. Simple magnetic treatment is not efficient when water is stagnating; with an EM field pulsating with creating frequencies will evidently have an effect on the water molecules, even though the water in the pipes is stagnating.

The Planet Horizons know how and the Aqua-4D technology consists of what frequencies and frequency combination to use to create a specific effect. PHT fundamental research in this domain allowed them to develop a table which could be compared the Mendeleev table, where the relationship of the resonance frequencies of atoms and molecules are the key element.

When applying a specific electromagnetic ambiance to an aquatic environment, certain other elements play also an important role to be successful. This can be taking into account external EM sources, which could influence the Aqua-4D EM treatment. The placing of the system at the right places in a piping system is crucial, the position of valves, pumps or other water treatment technologies has to be taken into account.

Today a plug and play modular product line is the result of all this know-how, making the application of this complex know-how simple to handle, and with certain application rules to multiply the correct professional use of this technology.

Beside all the practical success, a strongly increasing network of scientific partnerships, in French Universities, since end of 2011 with RTI International from North Carolina, USA, and official agricultural research institutes in Israel, Tunisia, France and Switzerland are direct proof of the success and the evolution on scientific level. These days a Eurostar project of a volume of Euro 1.2 Mio. has been accepted to be financed, it had to pass a scientific comity in Brussels. Together with PHT three French Universities and five research laboratories will do research on the effects on mineral scaling and biofilm development, including the effects on pathogenic elements like Legionella, for the application in water distribution and industry (cooling towers).

In summary PHT is convinced being today the leader in the industrial application of electromagnetic water treatment and the electromagnetic conditioning of aqueous environments in piping systems.

Sierre, June 2012, Walter Thut, CEO - Dr.Eric Valette, CTO