

Sonic Information No. E-3,17

Well Rehabilitation with high-energetic Ultrasound

Results from practical application



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1 Application

The **SONIC** – process is almost universally applicable

The ultrasound procedure was already entered in the DVGW regulations in 2001, which acts as the standardization entity for the well construction trade. As a result, the ultrasound method is applicable and suitable for all types of filters, while all other mechanical methods have application limitations.

| Application of Mechanical Regeneration Depending on Well Construction | | | | | | | | | | |
|--|-------------|-------------|------------------|-----------------------|------------------------|---|-------------------|--------------------------------------|------------|------------|
| Well construction | Overpumping | Surge block | Injection of CO2 | Low pressure flushing | High pressure flushing | High pressure flushing (within the gravel by a lance) | High pressure jet | Water-Air Compression by oxyhydrogen | Blowing up | Ultrasound |
| Slot screen | ++ | + | ++ | ++ | ++ | | ++ | ++ | ++ | ++ |
| Bridge-slot-screen | ++ | ++ | ++ | ++ | ++ | | ++ | ++ | ++ | ++ |
| PVC Filter | ++ | ++ | ++ | + | + | | + | ++ | - | ++ |
| slotted filter | ++ | ++ | ++ | + | ++ | | ++ | ++ | ++ | ++ |
| Ceramics filter | ++ | + | + | ++ | + | | + | + | - | ++ |
| Wooden Filter | ++ | + | - | + | + | | + | + | - | ++ |
| Gravel screen | + | - | - | - | + | | - | + | + | ++ |
| Glued filter | + | - | - | - | - | | - | - | - | ++ |

++ suitable and recommended

+ conditionally

- not recommended

No comment: method is not applicable

Source: DVGW W 130 (2001)

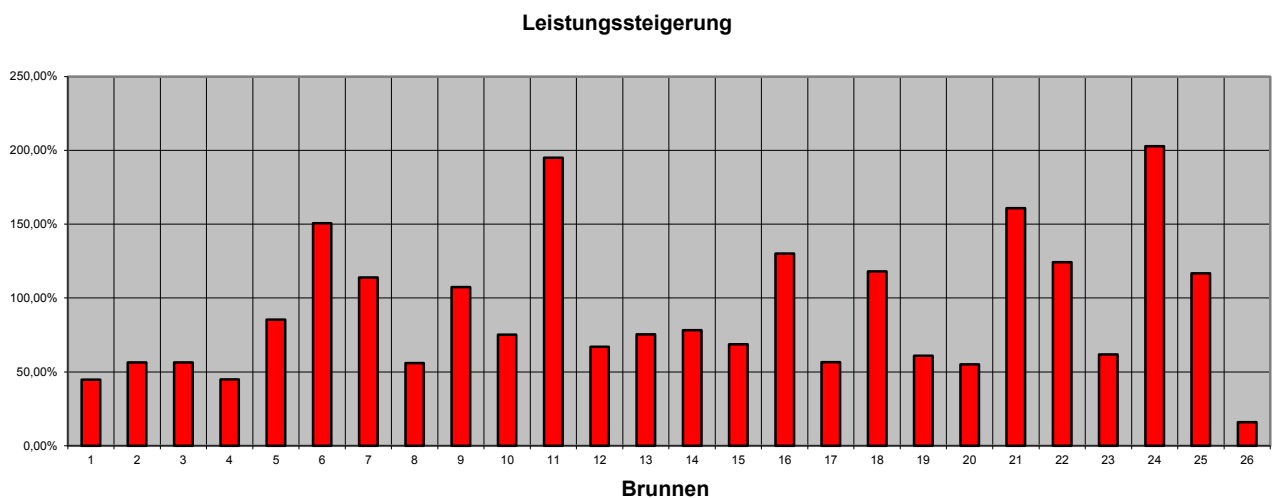
From the large number of ultrasound sonic rehabilitations performed with ultrasound, some remarkable results from practice are shown below.

sonic technologies GmbH
 Weyberhöfe 5-7
 63877 Sailauf
www.sonic-technologies.com
info@sonic-technologies.com

2 Results from practical application

At least 1000 well rehabilitations with SONIC ultrasound have been carried out successfully.

The following example shows a random average of the results of one user during a certain period of time.



Some extraordinarily remarkable results are shown below.

3 Mineral wells

For understandable reasons the ultrasound treatment is especially favoured by operators of mineral wells. It became clear, that in addition to the increase of efficiency also the content of minerals in the water is stimulated by ultra-sound.

The report of the mineral water company shows:

“ In April 99 the filter tubes have been cleaned by ultrasound. The result of this measure was a rise of the water level in the well (with identical drawing-rate before and after the treatment) from –10m to –6.5m below the upper edge of the well head. The water contained 25 % more minerals. This rise of the water level and content of minerals in the water corresponds a “rejuvenation” of the well of about 10 years.”

The original text:

gerne teilen wir Ihnen das Ergebnis der Ultraschall-Behandlung unseres Tiefbrunnens mit.

Sowohl die Ergiebigkeit als auch die Mineralisation unseres Tiefbrunnens reduzierte sich nach über 20 jährigem Betrieb beträchtlich. Eine Kamera-befahrung zeigte eisenhaltige Inkrustationen im Bereich der Filterrohre in 120 bis 135 m Tiefe.

Im April 99 wurden die Filterrohre einer Ultraschallbehandlung unterzogen. Als Ergebnis dieser Maßnahmen stieg der Wasserspiegel im Brunnen (bei identischer Wasserförderung von 5 l/min vor und nach der Behandlung) von -10 m auf -6,5 m unter Brunnenkopf-Oberkante an. Die Mineralisation stieg um etwa 25 % an. Diese Zunahme sowohl der Ergiebigkeit als auch der Mineralisation kommt einer „Verjüngung“ des Brunnens um etwa 10 Jahre gleich.

In der Anlage finden Sie die Entwicklung der Mineralisation des geförderten Wassers nach der Ultraschallbehandlung: Vor der Behandlung enthielt ein Liter Wasser 4750 mg NaHCO_3 (das sind 57 mmol/l). heute wird eine Konzentration von 6050 mg gemessen.

Mit freundlichen Grüßen

sonic technologies GmbH
Weyberhöfe 5-7
63877 Sailauf
www.sonic-technologies.com
info@sonic-technologies.com

4 Wells with two sections of inflow

The well with a total depth of 122 m had two sections of inflow in depths from 30 to 52,5 m and 92,5 to 122,5 m. The lower section was completely silicicated and did not contribute to the total volume of the inflow.

After the rehabilitation with ultra-sound a flow meter measuring was carried out. The result of this measuring showed that the lower section now again had a 25% share of the inflow.

The efficiency nearly doubled.

| Depth | Flowrate | |
|----------------------|-----------------------|----------------------|
| | before Rehabilitation | after Rehabilitation |
| 0,00 m | | |
| section of no inflow | | |
| 30,00 m | | |
| section of inflow | 100% inflow | 150% inflow |
| 52,50 m | | |
| section of no inflow | | |
| 92,50 m | | |
| section of inflow | no inflow | 50% inflow |
| 122,50 m | | |

5 Rehabilitation with SONIC ultrasound after high pressure cleaning and chemical treatment

In this case the well first had been treated with a high pressure cleaning procedure and then with a chemical rehabilitation.

The flow meter recording after the high pressure and the chemical treatment is shown in the following graph. („before the ultrasound treatment on 15.02.1999“).

Some days after these two treatments the well was rehabilitated with ultra-sound.

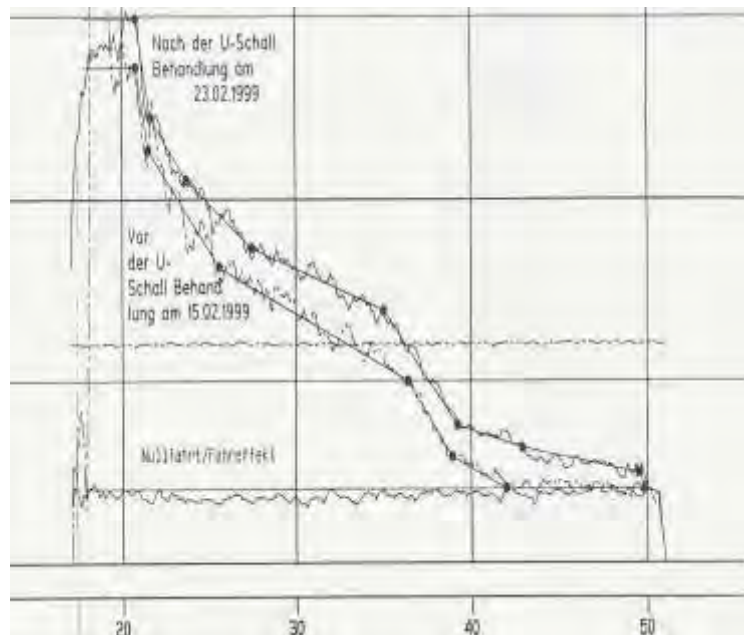
A further improvement of the specific efficiency from 16,9 m³/h*m to 19,1 m³/h*m is recognized.

In addition the evaluation of the flow meter curve shows, that the ultrasound treatment opened filter areas, which have not been opened before by either of the two conventional treatments.

Technical data of the well:

| | |
|-----------------|-----------|
| Total depth: | 49 m |
| Lining: | stoneware |
| Rock type: | sands |
| Filter surface: | 29 m |
| Diameter: | DN 250 mm |

Flow meter diagram and evaluation after test cleaning

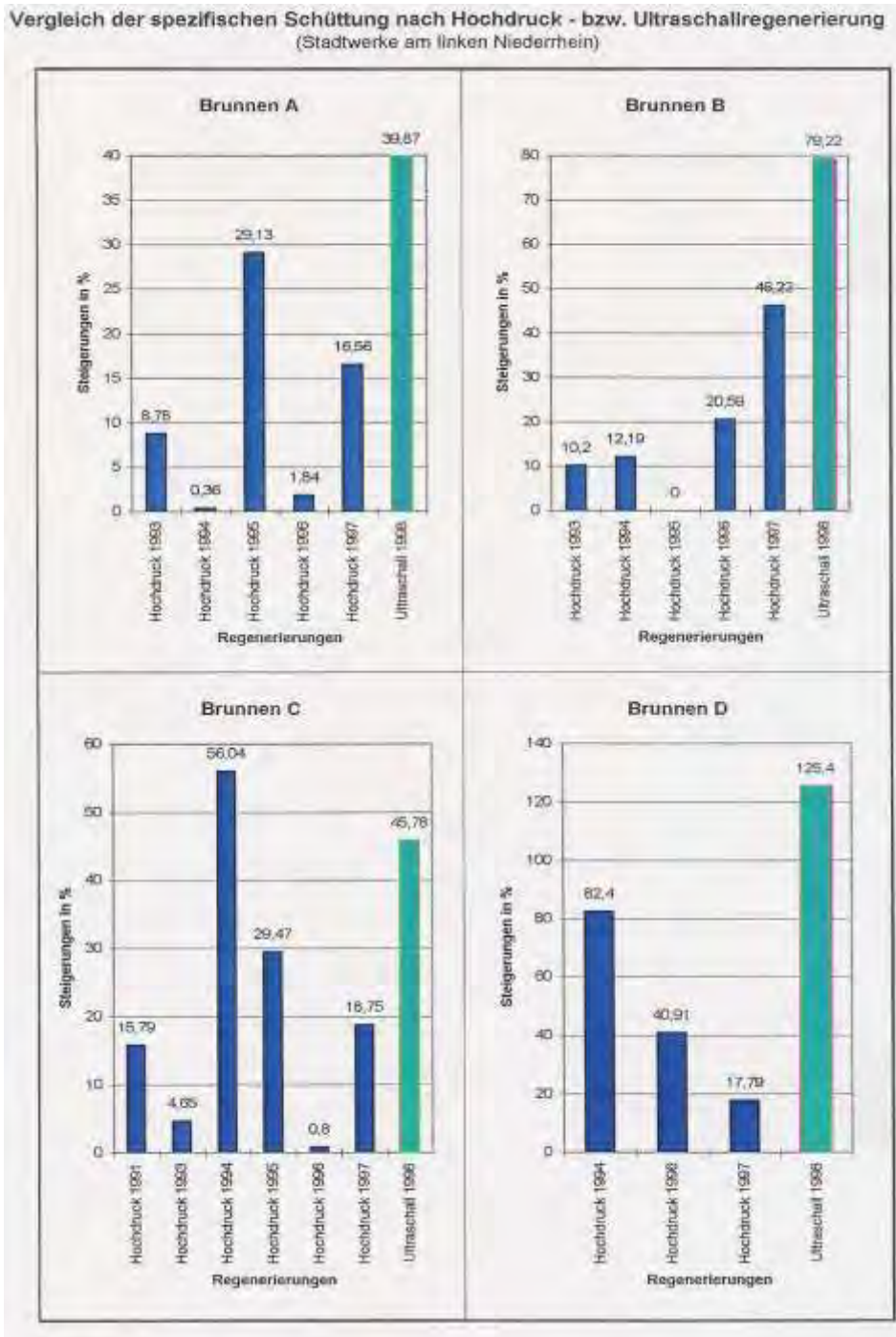


This test confirms without doubt, that the ultrasound reacts within the gravel infill. As the previous treatments had removed all settlements in the area of the filter slots, a further increase of efficiency can only be achieved by reactions within the gravel infill.

sonic technologies GmbH
 Weyberhöfe 5-7
 63877 Sailauf
 www.sonic-technologies.com
 info@sonic-technologies.com

6 Well gallery on the lower part of the river Rhine

A well gallery, which previously was mechanically rehabilitated once a year, was rehabilitated with ultrasound for the first time in 1998. The results of the ultra-sound rehabilitation are clearly better than the results of conventional treatments.



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sonic technologies GmbH
Weyberhöfe 5-7
63877 Sailauf
www.sonic-technologies.com
info@sonic-technologies.com

7 Rehabilitation of infiltration wells

A gallery of infiltration wells in the Rhein-Main area was rehabilitated with chemical treatment and with a shock pump in 1992 and 1993. A lasting increase of the water volume could not be achieved in either of the rehabilitation measures. In the end of 1994, in the course of the test program, two especially difficult wells were treated with ultrasound. The rehabilitation was evidenced by experts.

The expert opinion reported:

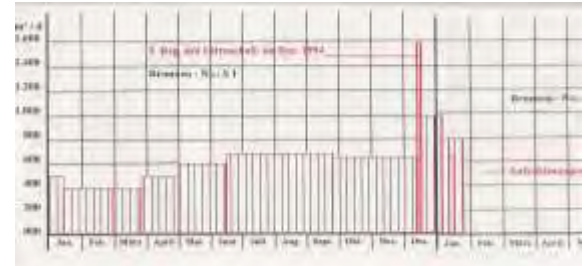
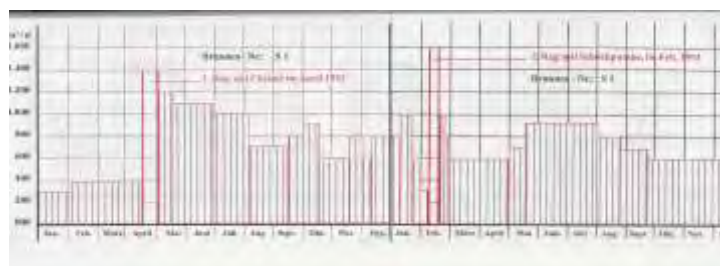
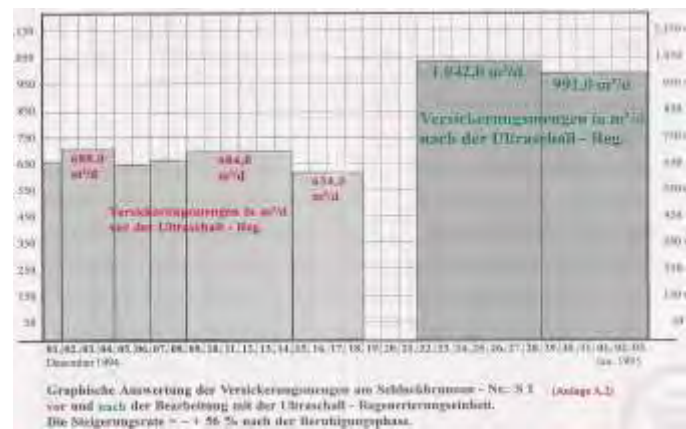
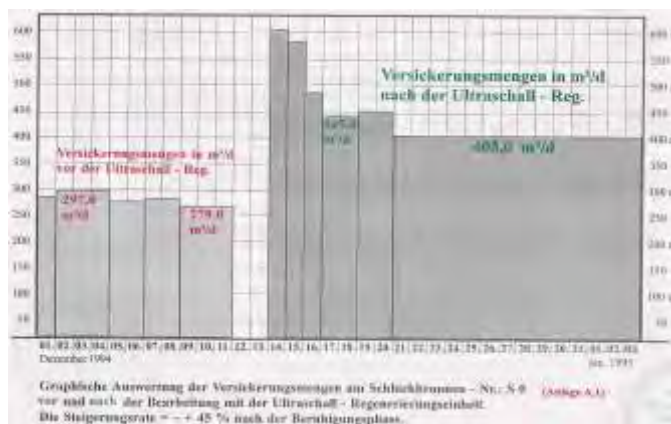
„In this case the well rehabilitation times of the wells are as follows:

- A. 1992 – Reh. by chemical treatment – 30 days
- B. 1993 – Reh. by shock pump – 10 days
- C. 1994 – Reh. by ultrasound – 5 days¹

Before the rehabilitation works were carried out the generally usual necessary camera recordings were taken, which did not show any settlements in the area of the filter slots.

A conclusion of this is, that the signs of well aging ...occur as settlements within the gravel filter.

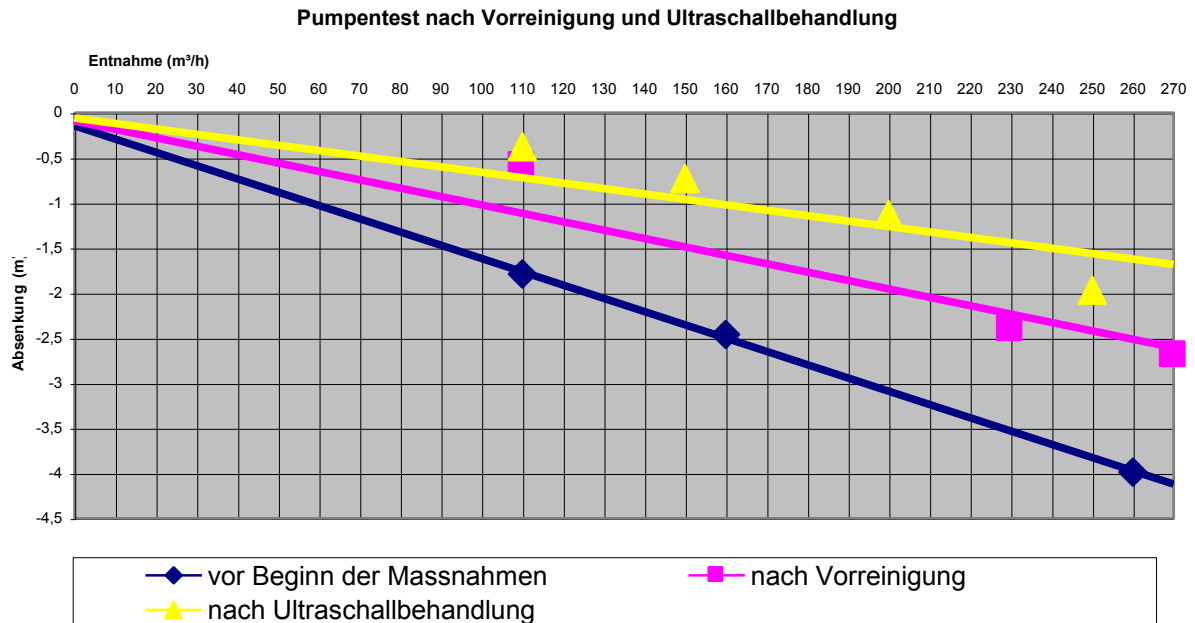
The ultrasound treatment resulted in a lasting increase of the efficiency of 45% resp. 56% after the stabilisation phase of the well.



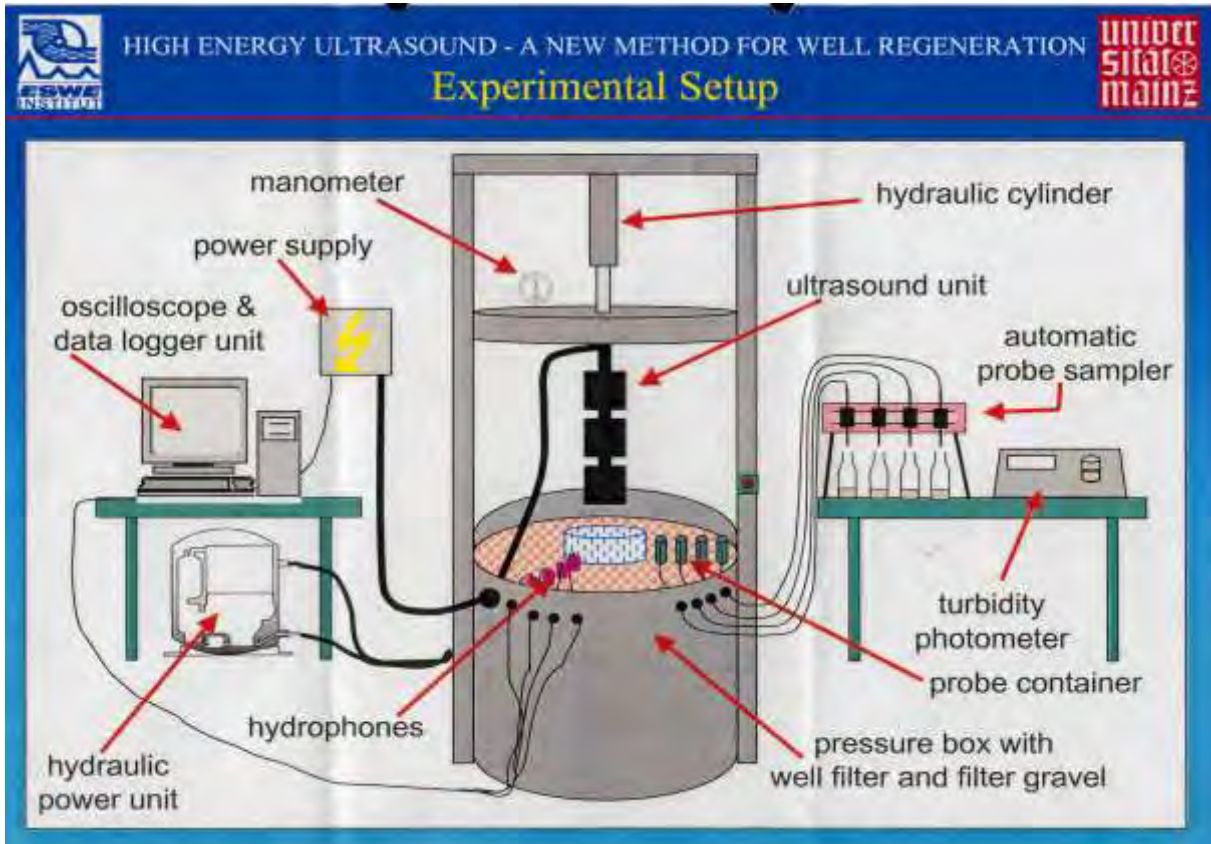
¹ The test was made during the development of the system

8 Well in France

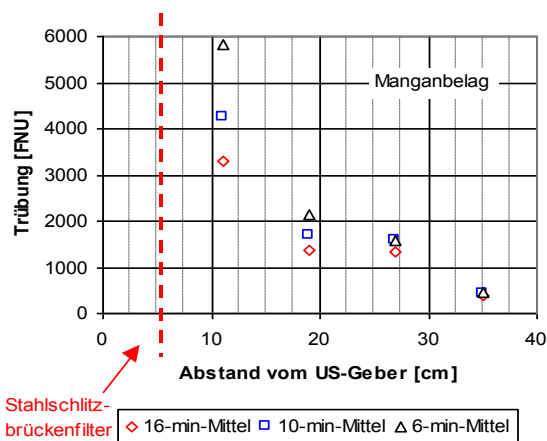
To measure the results of precleaning and ultrasound treatment pumping tests were made before treatment, after brushing and after ultrasound treatment.



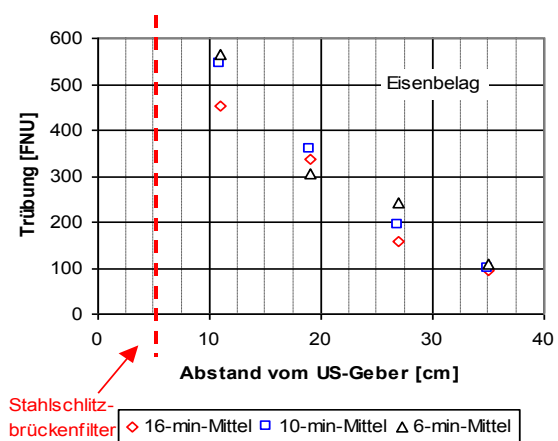
9 Results of scientific research program



A scientific research program at the university of Mainz proved the effectiveness of SONIC Ultrasound in the gravel pack²



measurement of turbidity (manganese), 5 bar, in sector L



measurement of turbidity (iron), 5 bar, in sector L

² Details are described in brochure E9
sonic technologies GmbH
 Weyberhöfe 5-7
 63877 Sailauf
 www.sonic-technologies.com
 info@sonic-technologies.com

The final Report of the German Foundation for the Environment

The excellent effectiveness and sustainability of the procedure has been clearly demonstrated in many years of practice as well as in the above mentioned independent scientific research project, which was funded by the German Foundation for the Environment³

From the final report of DBU (2001):

"The ultrasound process is a modern, efficient and competitive process for the regeneration of an aged well. The penetration depth of the ultrasound and the cleaning effect could be shown both in the laboratory and in the practical tests. Compared to other mechanical processes, the construction-friendly and speedy operation is particularly beneficial. Compared to chemical processes it is very environmentally friendly, since the use of aggressive chemicals can be dispensed with completely. In the course of this, the complicated application for water rights permits is also omitted. Despite the complete absence of chemical substances in groundwater, a high cleaning performance is achieved. Due to the short downtime of the well, the positive cost-performance ratio and the chemical refinement of the method, it can be categorized as an ecologically and economically sensible process. The results were summarized in a final report and published as a special edition of the ESWE Institute ".

³ https://www.dbu.de/projekt_18276/01_db_2409.html
http://www.sonic-umwelttechnik.de/pdf/Entwicklung_eines_Verfahrens_zur_Brunnen-Regenerierung_mittels_einer_Ultraschall-Einheit.pdf

Practical application and scientific research show:

Well rehabilitation with SONIC Ultrasound is

- **Highly efficient**
- **Environmentally friendly**
- **Saving the well structure**
 - **economical**