

REAL TIME SURVEILLANCE STATION OF DRINKING WATER QUALITY IN THE PROVINCE OF TERAMO (ABRUZZO REGION - ITALY)

Istituto Zooprofilattico Sperimentale dell'Abruzzo e
del Molise "G. Caporale"

Ruzzo Reti Spa



Who we are

ISTITUTO ZOOPROFILATTICO SPERIMENTALE DELL'ABRUZZO E DEL MOLISE "G. CAPORALE"



a public health Institution operating in:

- Animal Health;
- Veterinary Public Health;
- Public Health;
- Food Safety;
- Environmental Protection.



Food



Who we are



An Institute:



- **with over 400 employees (veterinarians, biologists, chemists, statisticians, technicians, clerks, administrative staff);**
- **the Italian Ministry of Health has designated the Institute as National Reference Centre and National Reference Laboratory in several areas;**
- **the WHO, FAO and OIE have assigned the role of International Collaboration Centre and Reference Laboratory in specific spheres of activity.**

What we do



Our tasks include:



- **Scientific research and monitoring**
- **Consultancy and technical assistance for international Cooperation**
- **Dissemination of information and scientific research**
- **Development of Technological aids**
- **Managing National Data Bank for Livestock Registration**

Our location



Our headquarters are in Teramo, a City in Abruzzo Region, approximately 180 km NE of Rome.

There are also five area diagnostic centres in Abruzzo and Molise



**We work in
collaboration
with**



RUZZO RETI SPA



**The water work company managing
the Integrated Water Service for the
City and Province of Teramo:**

- public water collecting, adduction and distribution services for municipal use,**
- sewerage and waste water treatment.**

What does RUZZO do?



RUZZO manages the integrated water service for 140,000 customers, extending over 40 municipalities in the province of Teramo by:

- **collecting of 1200/1500 L/sec from 119 groundwater sources in the Gran Sasso aquifer,**
- **maintaining 2110 km of water supply lines, 900.8 km of sewer lines and 86 wastewater treatment plants.**

COLLABORATION IZS A e M - RUZZO RETI SPA



Background



Gran Sasso Aquifer



- **The Gran Sasso chain is located in the Central Apennines and contains one of the largest aquifers of Central Italy.**
- **The massif can be defined as a partitioned fractured aquifer of about 700 km² with well-defined hydrogeological boundaries.**
- **It contains a huge groundwater resource, with an estimated recharge of $600 \cdot 10^6$ m³/y supplying drinking water to 800,000 persons.**

Sensitive points of the aquifer

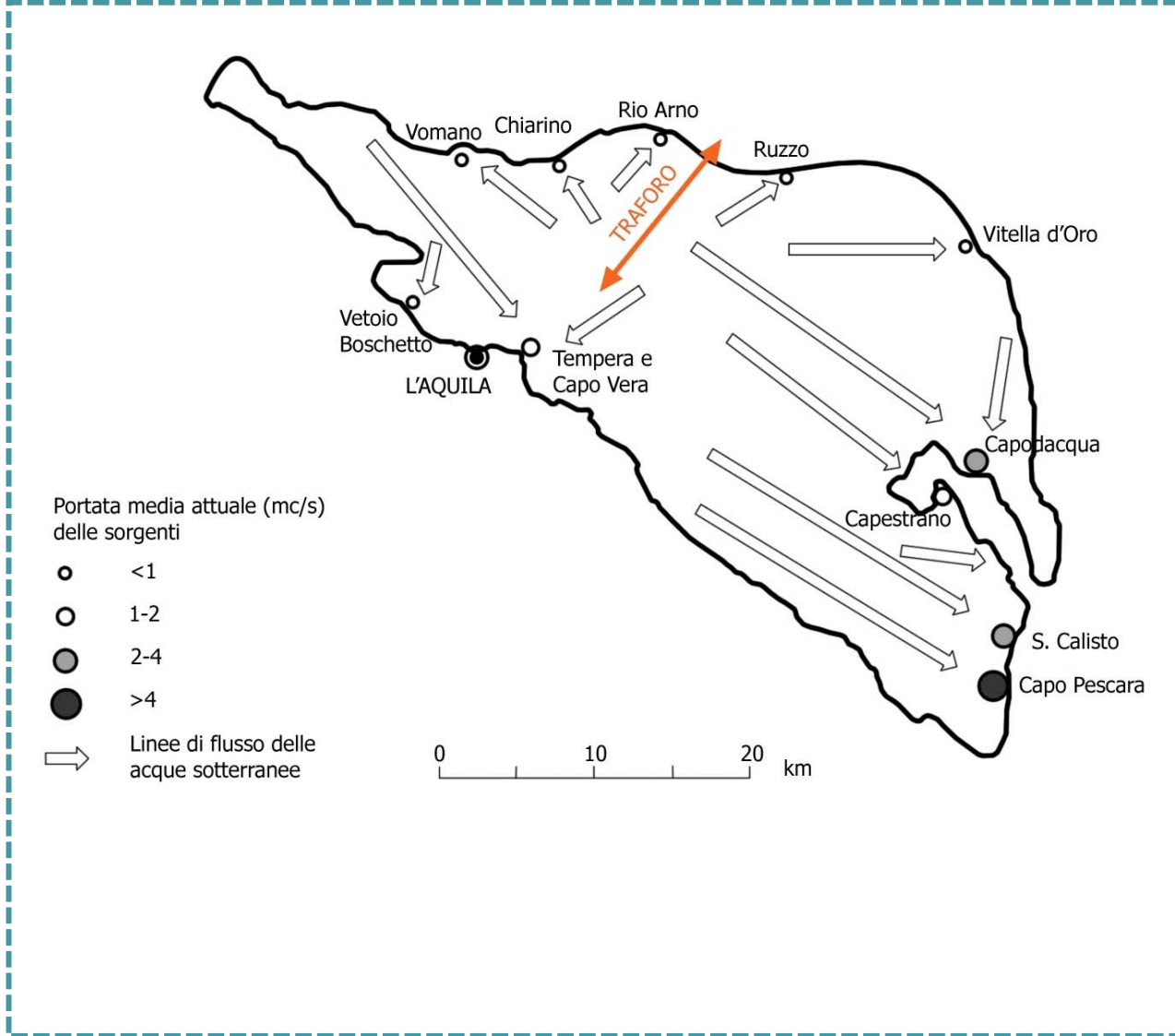


The underground laboratory (National Institute of Nuclear Physics - INFN) was built in the early 1980s when two motorway tunnels (10 km) were drilled into the Gran Sasso massif.

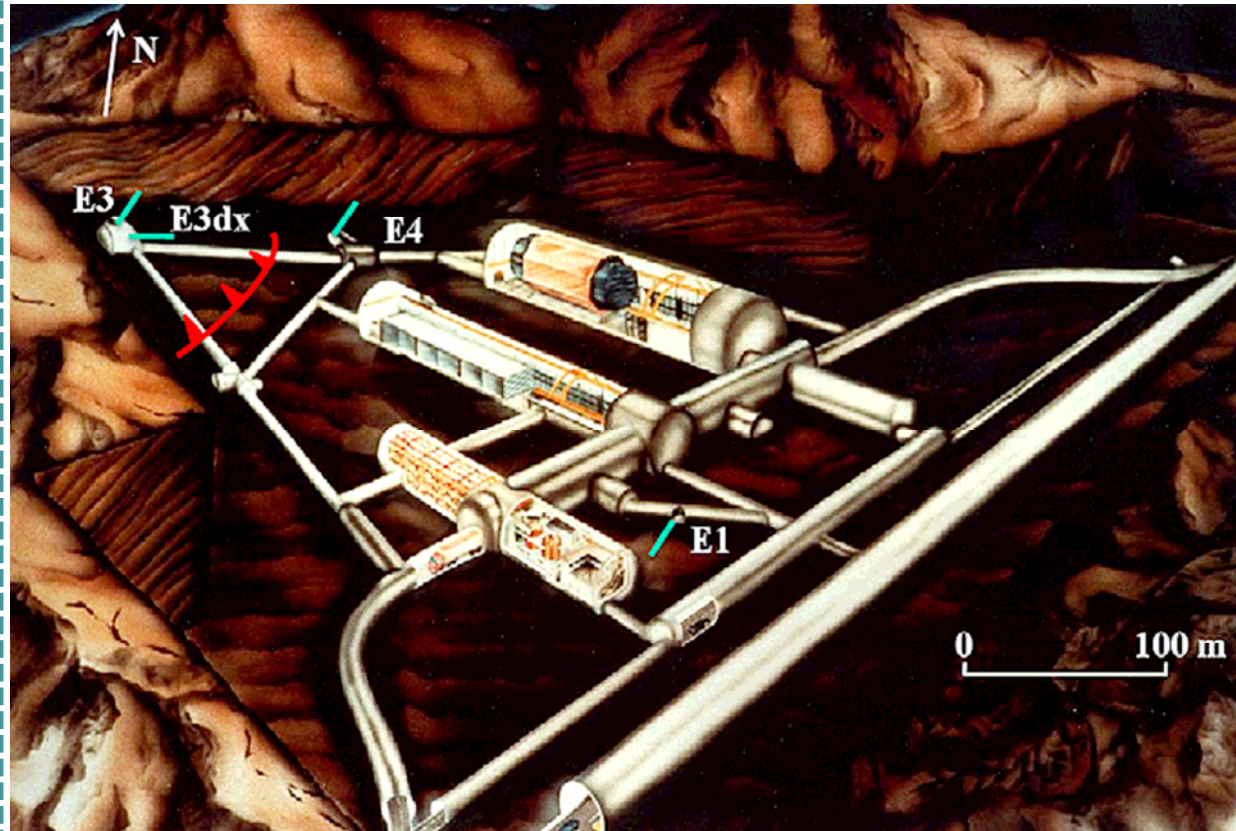
During the building the workers intercepted the Gran Sasso Aquifer. It required a huge and complex canalization of water and drainage system feeding the Aqueduct of Teramo.

The surrounding water of highway tunnels and INFN is subjected to a continuous control managed by Ruzzo Reti SpA partially in collaboration with IZS AeM.

Gran Sasso hydrogeological system



INFN and highway tunnels



Schematic view of the LNGS-INFN. The overthrust fault (red line) and monitoring sites (E1, E3 and E4) are also shown. At site E3 there are two sampling points: E3 which is parallel to the overthrust fault in the North direction; and E3dx which is orthogonal to the fault in the E4 direction into the cataclastic rocks.

COLLABORATION IZS A e M - RUZZO RETI SPA



Current Objectives



Current objectives

To detect accidental spills and/or contamination i.e. coming from a temporary on-working activities carried out in one of the two tunnels placed just above the water sources or from underground laboratory INFN.



Overall objective

To ensure the public health enhancing the detection capability of chemical/physical monitoring station placed at Casale San Nicola with an early warning biological system “Daphnia Toximeter”



Surveillance system of stations and posts



1. One monitoring station placed on the west side of the Gran Sasso massif (control room operated separately by A. L'Aquila)
2. One monitoring post placed at the outlet point of the INFN underground laboratory, placed inside the highway tunnel to control the quality of the underground water surrounding this area;
3. Two monitoring posts mounted near large pools at the end of a 2,7 km long service tunnel under the highway tunnels, used for the collection of the water drainage at the east side of the aquifer and directly feeding the Ruzzo aqueduct;
4. **CASALE SAN NICOLA STATION** is located at, just outside the service tunnel and it is used to control the water collection pools feeding the same distribution system.

CASALE S. NICOLA STATION

Teramo



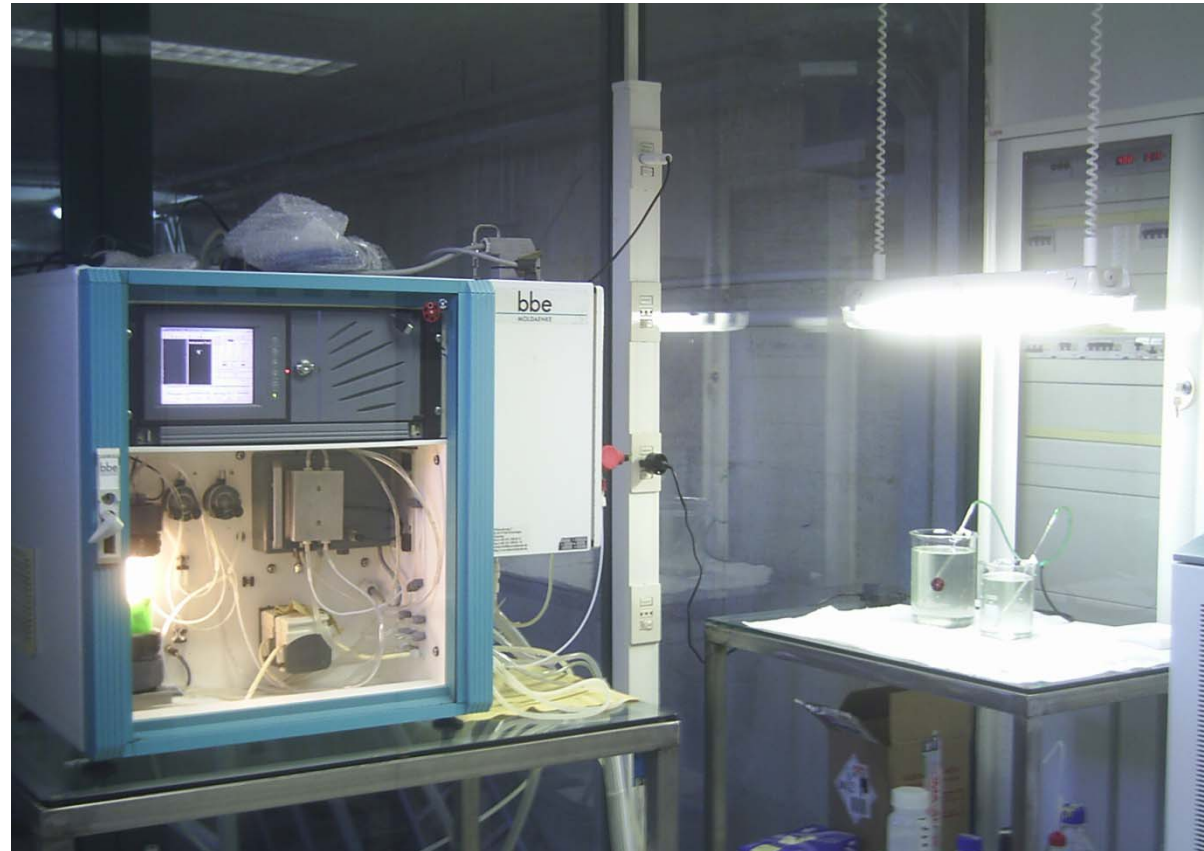
External entrance to the underground
monitoring station

Biomonitoring system

Casale S. Nicola Station



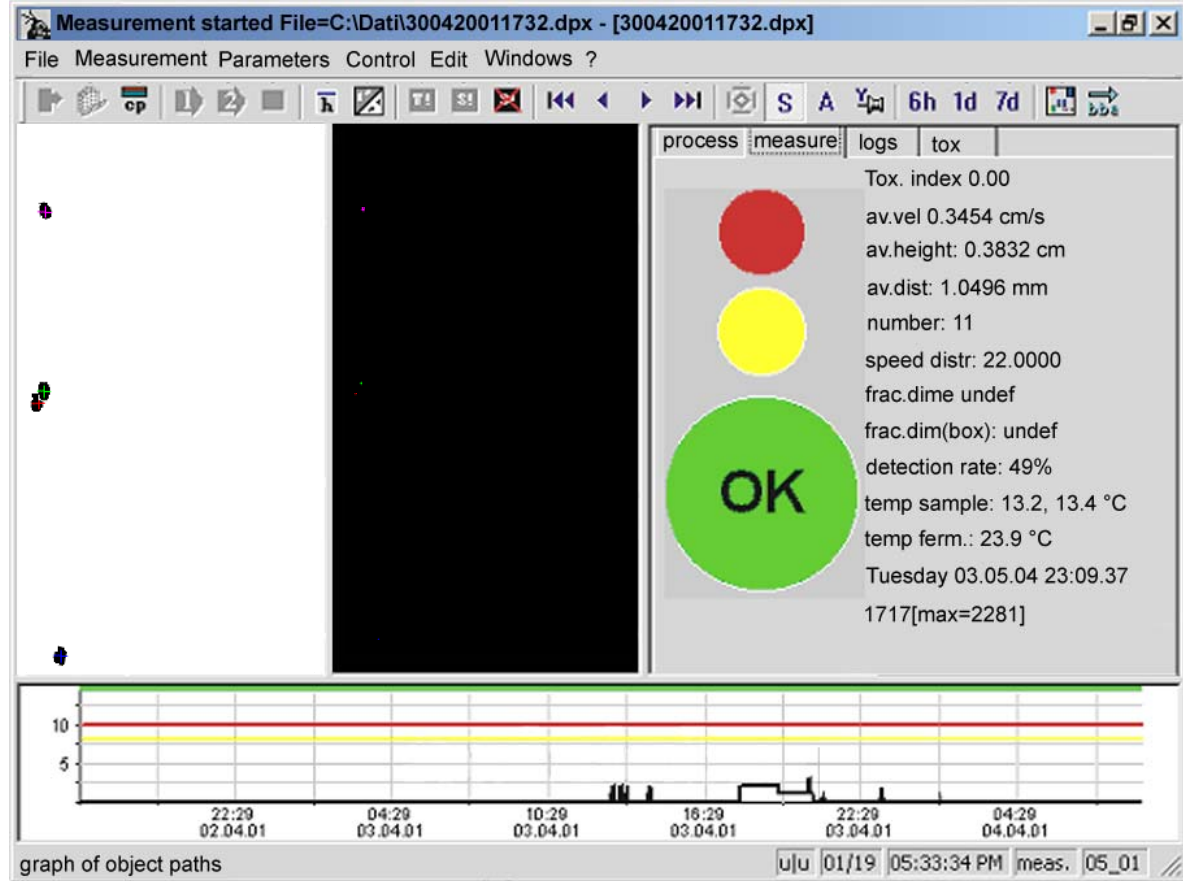
Daphnia magna



1) *Daphnia* Toximeter

2) *Daphnia magna* culture

The Daphnia Toximeter at work



Chemical/physical monitoring systems

Casale San Nicola Station



- 1) **Multiparametric sensor UV** - scan mod. spectrolyser –
(Total Organic Carbon-TOC, nitrate,
Dissolved Organic Carbon - DOC, turbidity)
- 2) **TOC**: range 0-10 ppm, reliability limit 0,001 ppm
- 3) **Hydrocarbon**: range 0-10 ppm, reliability limit 0,03 ppm
- 4) **Ammonium ion**: range 0-10 ppm, reliability limit 0,01 ppm
- 5) **Nitrate**; range 0-1 ppm, reliability limit 0,001 ppm
- 6) **Turbidity**: full scale 500 NTU
- 7) **Conductivity**: full scale 1000 $\mu\text{S}/\text{cm}$
- 8) **Flow rate**: full scale (1) 1800 L/s; (2) 700L/s

Real time Data management centre

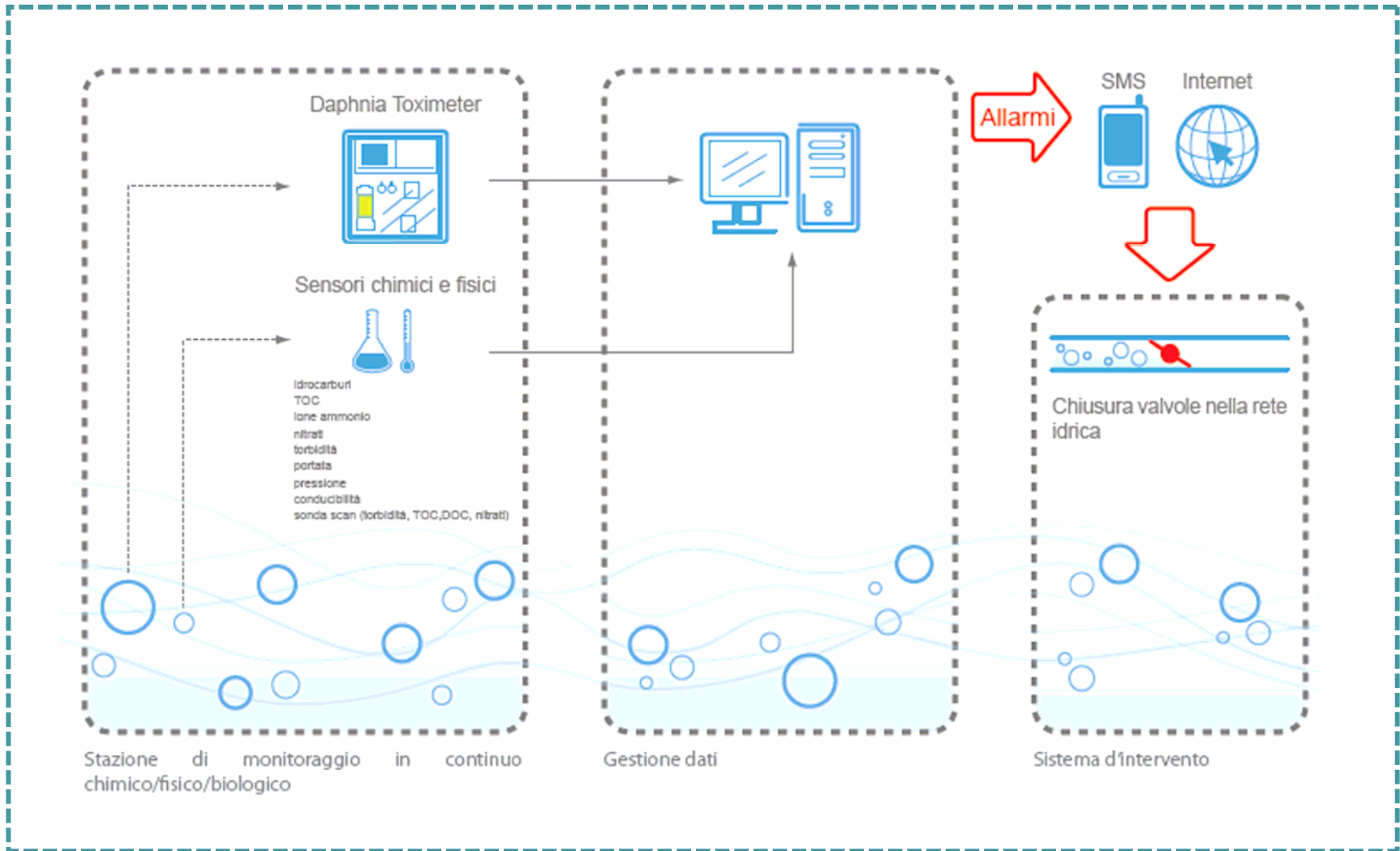
ZETASTATION software
(SYSTEVA Srl)

- This software architecture provides reliable real time connectivity of monitoring nodes with its surveillance centre and storage of large amount of data.
- Based on TCP-IP networking, it allows for secure real-time communication between the EW monitoring stations and the Surveillance Management Centre for the purpose of data acquisition and remote control of monitoring stations;
- it analysis and assesses all data against given parameters. If anomalies are detected, it transmits a warning, sending it to our internet site and by, SMS, to designated operators, triggering the emergency by-pass valve system.

Emergency by pass system



An essential part of a very detailed Emergency Plan is the emergency by pass system: at specific sites of the distribution system network there are a number of remote controlled (also manual) by-pass valves which allows for the quick redirection of potentially contaminated water away from public use.



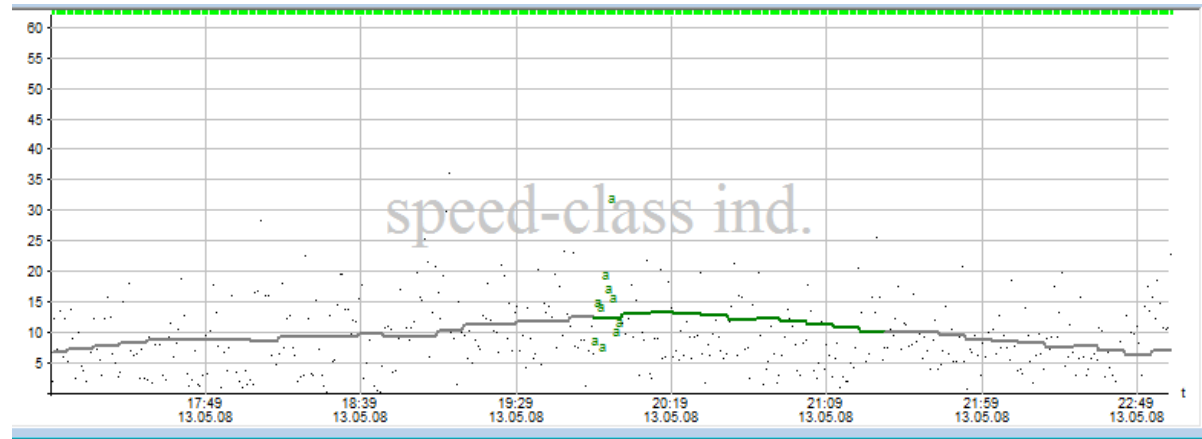
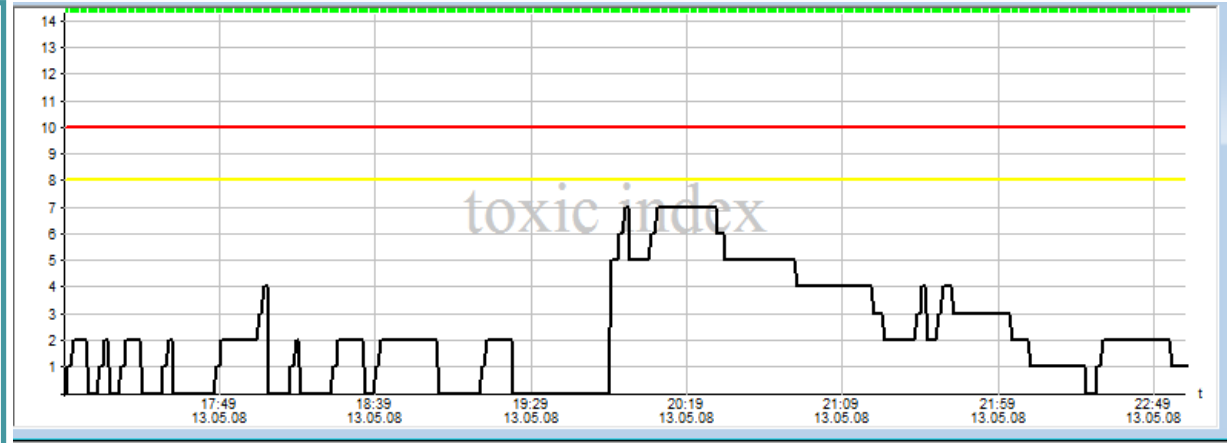
Schematic Graphical representation of Surveillance Station

Real time surveillance station in action: fire drill

- AT 10,00 a.m. on 14th of May 2008, a burning car was placed at the entrance of INFN, deep inside the highway tunnel.
- Immediately the alarm was send off and all designated authorities were triggered into action;
- At 10,15 the turbidity sensor (service tunnel-pool) relieved the value of 6.8 NTU;
- At 10,20 DTOX showed a toxic index equal to 8 points due to speed class index;
- Ruzzo immediately activated the emergency valves redirecting the potential contaminated waters.



Real time surveillance station in action: fire drill _ 1 day before



Conclusion



Given the essential role of real time surveillance for drinking water quality, we consider important the research, development and diffusion of BEWS as preventative measures to apply in order to ensure the public health.

Thank you for your attention

