



GHGT-9

Communication Strategy for a public information campaign on CO₂ geological storage and on CCS as a whole: the case history in Italy from 2003 to 2008

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Abstract

In the frame of the INGV activities of the Group 5 of the European Platform on Zero Emissions Fossil Fuels Power Plants (Eu ZEP) INGV resumes 8 years of experience in public communication on CCS aimed to the public acceptance of this strategic group of technologies. This paper follows from the beginning (2000-2008) the history of the communication and public acceptance campaign in Italy, discriminating in details the bad/sound messages appeared on newspaper, TV, video and conference, mostly as regard the possible natural risks associated to a newly exploited technology: CO₂ Capture & Storage (CCS), namely degassing/leakage to surface and triggering of micro-seismicity typically associated to industrial fluids injection.

The most important messages, the mediatic errors and the obstacles encountered during this long communication campaign, mostly exploited by INGV in Italy, are described critically, tentatively avoiding that the involved stakeholders make the same mistakes in future and do not adopt the herewith suggested protocols of communication. This is strategic mostly in densely populated countries, like the European ones, often affected by the NIMBY syndrome (Not In My Back Yard) for new plants which could foreseen the CO₂ storage sites in the vicinity.

In the frame of the European Directivity on CCS, the above mentioned risks are mainly supported and charged on the "storage operator": and this load is not soundly taken in considerations in the directivity itself: these risks must be spread on the "capture" community and on the "Competent Authority", otherwise the "storage operators" are not encouraged to enter in the CCS market.

INGV describes its experience in creating good communication in public populated events like the "Science Festival" held in Lecce (May 2008) and the "Science Festival" held on Genova (October 2008), also by facilities as plastic interactive CCS scaled box reproducing the CO₂ storage techniques, for a complete and simple communication with general public and stakeholders. The most important messages to be highlighted on CCS are mentioned and critically reviewed in the newspaper articles since the USA-Italia bilateral agreements on the climate change, including CCS at that time.

1. Rationale

INGV is the biggest Italian and European institution devoted to the natural risk assessment (seismic, volcanic, degassing, etc...) over the Italian territory as a whole and abroad (Greece, mediterranean networks, etc...), covering a lot of risk tasks for the Civil Protection Department (DPC), by decades of DPC-funded conventions and by a 24-h full surveillance, being installed a lot of geophysical and geochemical surveillance networks, over the country as a whole, with more than 500 geophysical and geochemical continuous monitoring stations as a whole. They are measuring CO₂ related parameters and micro-seismicity respectively. These risks and the accurate knowledge of the CO₂-associated risk areas, namely the “CO₂ analogues” are the same of those which possibly will formed at surface, namely the *Diffuse Degassing Structures* (DDS as defined by Quattrocchi et al., 2007 see also Rogie et al., 2000; Chiodini et al., 1995, 1998; 2000, 2001; Brombach et al., 2001; Cardellini et al., 2003; Chiodini & Frondini, 2001; Quattrocchi et al., 2001; Annunziatellis et al., 2003; Quattrocchi, 1999; Pizzino et al. 2004 a,b, 2008; Angelone et al., 2004; Voltattorni et al., 2004, 2006; 2008 a,b, Tassi et al., 2008; Pizzino Wiesberg et al., 2007) in association to a not-accurate choice of the CO₂ injection site, with consequent possible CO₂ leakage and seepage in soil gases and indoor, as well as to over-pressuring up to trigger micro-seismicity.

This Italian experience, due to a geodynamically active and CO₂ naturally degassing country, is now transferred to the CO₂ storage scientific community over the world, at the beginning in the frame of the IEA-EU Weyburn EOR-CO₂ Project by reservoir and soil gas monitoring (2000-2005, Jones et al., 2004; Cantucci et al., 2006). Successively INGV started a lot CCS projects and a CCS public campaign in Italy, by i) a lot of CO₂ Geological Storage feasibility studies (Sulcis-Sardinia, Alto Lazio, Calabria, Ribolla-Tuscany, Adriatic Sea, etc...) and by the compilation of the “Italian Catalog of CO₂ storage sites” in Italy (Quattrocchi et al., 2007), and by ii) a lot of public communication events and media interview on CCS. INGV decided in particular to build up public stands at the “Energy Festival” held in Lecce and at the Science Festival held in Genova, during 2008 to start positive case history of its communication strategy.

This huge work had the consequence that both the Ministries (Environment and Economic Development) involved INGV, starting from 2000, with a first role in the communication campaign about CO₂ geological storage, both on newspapers and in public debates/conferences, as well as by encouraging meetings with NGOs, performed in the course of 2005-2007 period. Open communication is now installed with the Kyoto Club, including WWF and Legambiente, trying a common road-map to present CCS to the general public. INGV decided that one of the steps have to be an effort in organising also an International School on CCS, which was effectively held in Erice (Sicily, November 1-7, 2007), inviting Chinese and Indian students too, as suggests by the critical and impressive words of the World Energy Outlook 2007 compiled by IEA on the Chinese wrong development without clean coal technologies.

2. Methods

In the frame of the activities of the Group 5 of the European Platform on Zero Emissions Fossil Fuels Power Plants (Eu ZEP), where INGV is present, it is necessary to establish ZEP as a credible authority on all aspects on CCS and therefore it is necessary to identify ZEP spokespersons able to engage with the press in target countries. There is the need of a full-time ZEP Communication Manager to coordinate this work for each country, able to listen all the instances coming from the stakeholders, NGOs and general public and translated these inside the European decisional tables, creating a “bridge” between CCS scientists/regulators and the European countries population.

For this aim discussion have to be opened with the media critical people (scientific divulgators) and with the National press environmental correspondents coming from:

- general public science
- environment framework
- nature magazine and their staff
- TV and radio environmental correspondent

In the frame of the relation with the media the CCS scientific/regulation community have work in:

- creating and maintaining relationships with major environmental and energy journalists in target countries;
- generating news and actions that create news: organizing press events, press material, newsletters, pamphlets (as done by INGV for the Ciampino Marino CO₂ Diffuse Degassing Structure);
- increasing exposure to press of CCS experts via interviews, expert-authored articles, briefings, etc...

It is very necessary to start a dialog with NGOs both to make an accurate and continuously updated information on CCS, soon available to environmental NGOs and to work in partnership with certain “technical” NGOs as “observer” inside (not outside) the ongoing projects, to make CCS information available to a wider public, which actually are faithful only toward the NGOs and some (only some) scientist. The people have to understand that the scientific method follow a road-map that foresees “steps”, “gaps”, “pauses” during which a certain degree of uncertainty and stochastic approach (not deterministic) is normal. Only in the co-participation of the doubts is possible to enter in an harmonic cooperation during the scientific path, followed to reach a specific objective, i.e. the best choice of a geological site to store safely the carbon dioxide. In this way, and only in this way, the NGOs people, as “internal observer” within the project, being they normally very ideologised, could understand that the scientific method is not an ideology but a rationale path, with a lot of obstacles, to overcome day by day for the best and most safe selection both of storage sites and monitoring criteria.

An example of communication event on CCS was the Round Table at the end of the “International School on CCS” named “*CO₂ Capture & Storage: towards a common Italy-UK strategy within a global framework*”, in which INGV and their sponsors funded mainly Chinese and Indian students to participate; which countries have to learn more than the other countries to develop very soon the CCS operative project in clean coal technologies. The common discussion between policy and science was strategic in inviting the NGOs organizations to state the own point of view after a school were all the questions and problems on CCS exploitation were exposed clearly to allow the “environmentalists” to understand that today the “environmentalism” is meaning: “technology”. A new view of environmentalism arise staying INSIDE the CCS feasibility studies and operative projects and INSIDE the schools.

3. The concept of “sound use of a Diffuse Degassing structure”: the Tor Caldara DDS case

As described in this volume (see Monitoring session) the Tor Caldara DDS (Rome, Latium Region) is located inside the quiescent Alban Hills volcanic structure volcano, 20 km SE from Rome. It is associated to the Ardea Graben, as regional “transfer-anti Apenninic structure (see literature in Quattrocchi et al., 2007) and it is affected by a steady-state diffuse exhalation along a DDS line (Solforata-Pomezio, Vallerano, Ardea-Fossignano, etc....see Quattrocchi et al., 2001, 2007) of natural gases, mainly with CO₂ prevalent composition, as well as by historically recorded episodes of differential degassing, often in connection with moderate-low magnitude seismic events (see the resuming table in Quattrocchi et al., 2001), which affected periodically the Alban Hills volcanic structure. This slight but not absent correlation with seismicity suggests a common cause between gaseous release and stress-strain release at depth. Despite this intriguing correlation between CO₂ increased exhalation (advisable often only by continuous monitoring sensitive chemical sensors/seismometers and not advised normally by the human population) and micro-seismicity, these episode never involved “burst/explosions” or injuries of human life’s, nor the need to use the hospital for human beings, with the exclusion of some animal died (Pizzino et al., 2002). In previous papers, we tried to explain this close correlation by the phase-separation thermodynamic processes enhanced or triggered by extensive degassing stress episodes (Quattrocchi 1999 and references herein), but never we found in Italy during strong seismic events, episode of huge CO₂ out-gassing and burst, despite billions tons of CO₂ are naturally located underground in our country. In general, CO₂ associated geochemical anomalies could be correlated with the presence of buried faults, not necessarily active (Quattrocchi, 1999; Pizzino et al., 2004 a,b; Angelone et al., 2004). The Tor Caldara DDS, despite is one of the most CO₂ degassing area of the country (Quattrocchi et al., 2007), is used since many years as a WWF oasis to preserve the presence of very rare birds housing and it is seat of a visitation center with some “observation” steps along a naturalistic path, to allow the visitors to understand the unrest degassing activity of an ancient quiescent volcano: the presence of CO₂ and sulphur exhalations and secondary minerals precipitates, with living people in the vicinity (a few hundred meters among the maximum flux and the lived houses, as shown in figure 1) and the sound use of the DDS by the WWF NGO is a very positive public communication pathway for the CCS exploitation.

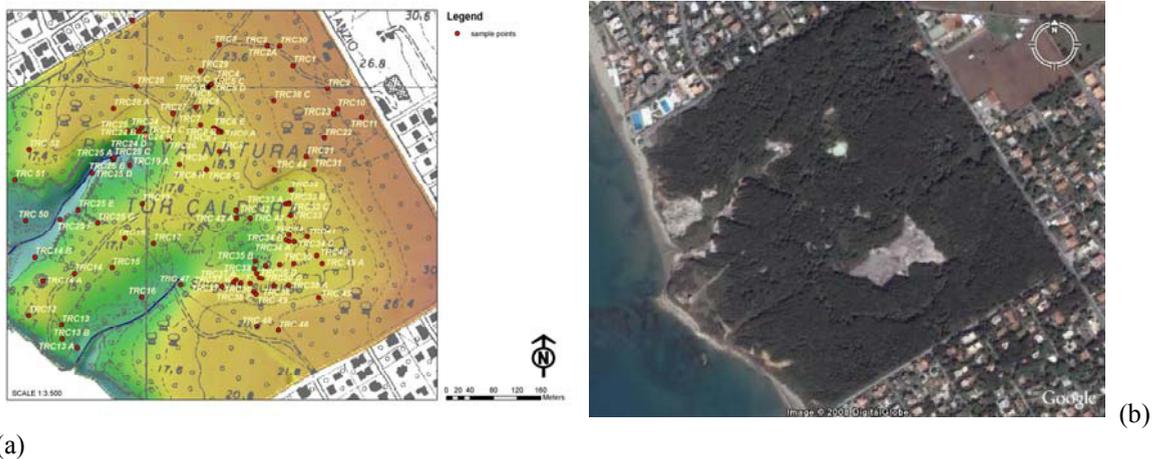


Fig 1 - Location of the Tor Caldara DDS as seat of a WWF bird-watching oasis: (a) INGVroutinary (once/year) sampling points (red) for soil gas analyses including ΦCO_2 within the DDS; (b) Remote sensing image of the DDS. It is clear the vicinity of lived houses, a few hundreds of meters from the degassing anomalies (no vegetation), since Roman Times. Also where the vegetation is still present, very high CO_2 fluxes are measured suggesting that remote sensing tool is not sound for very detailed survey of CO_2 anomalous flux surveys. This is to be considered in the ANNEX II protocol of the European Directivity on CCS: remote sensing repeated surveys could be too expensive for the cost benefits. Better is to concentrate financial efforts in funding detailed in situ CO_2 fluxes surveys. Ancient roman mine structures are still preserved after centuries, testifying the living houses also inside the actual WWF bird-watching oasis.

4. The concept of “maximum risk” associated to CCS

As a wide literature exist about the “maximum risk scenarios” for the nuclear power energy, or for other technologies, also for the CCS technology we have to define the “maximum risk scenario”. In particular we have to define what happens for a strong (as improbable) leakage of 1 %/year of the injected CO_2 from a clean coal plant which stored underground 10 Millions tons CO_2 /year, namely 200 Millions tons CO_2 in 20 years. In this case we could have, after some tens-hundreds of years as order of magnitude, 2 Millions tons in 20 years as leakage, caused by a not perfected sealing power of the caprock or newly faulting.

It is meaning the appearance at surface of a new DDS (as around 200 DDS are still present in Italy, see Fig. 2). THIS IS THE MAXIMUM RISK: produce at surface some phenomena that are still present widely in a geodynamically active country like Italy. Not an explosion, not a burst, not a mud-avalanche, not a wide un-breathing area, ... simply a very well localised-punctual DDS!!! These DDSs are completely manageable by a discrete or continuous automatic monitoring and often are seat of spa and holiday centres with thermal baths and muds, where INGV routinely sample to check the “associated fault” geochemical activity and sealing variations.

The DDSs are punctual leakage locations, not particularly changeable in position in the course of centuries, described and associated to ancient legendary historical cronacles since the Ancient Greece times. Since that time in Italy died, in association to a bad use of DDS (curiosity to enter in some mephitic apshittic lake, baths without prevention, smelling the exhalations too near to the gas mouths, lack of knowledge of these natural phenomena, not information or lack of net for prevention, etc...) around 10-100 people in 1000 years (800 people died in a unique year in Italy for car accident without “environmentalists” concern and manifestations).

Cicerone described the DDS Mefite d’Ansanto, the most degassing CO_2 flux in Europe (1000 tons/day, see Quattrocchi, 2007), located very close to the fault seismogenic segment (see Fig. 2) where the M=6.9 Irpinia earthquake occurred, without any visible modification of the DDS CO_2 flux, nor explosions or burst during/after the destructive earthquake.

In summary those 2 Millions tons CO_2 leaked in 20 years at surface, responsible of the creation of a new DDS, should be responsible to create something appearing at surface as the Val Comino or the Palidoro DDS (see this Volume and Fig. 3)

This is actually the state of art of maximum risk assessment of the CCS technologies (Report IEA-GHG N. 2007/02), and we have to communicate clearly this to NGOs and to the general public and policy Authorities.

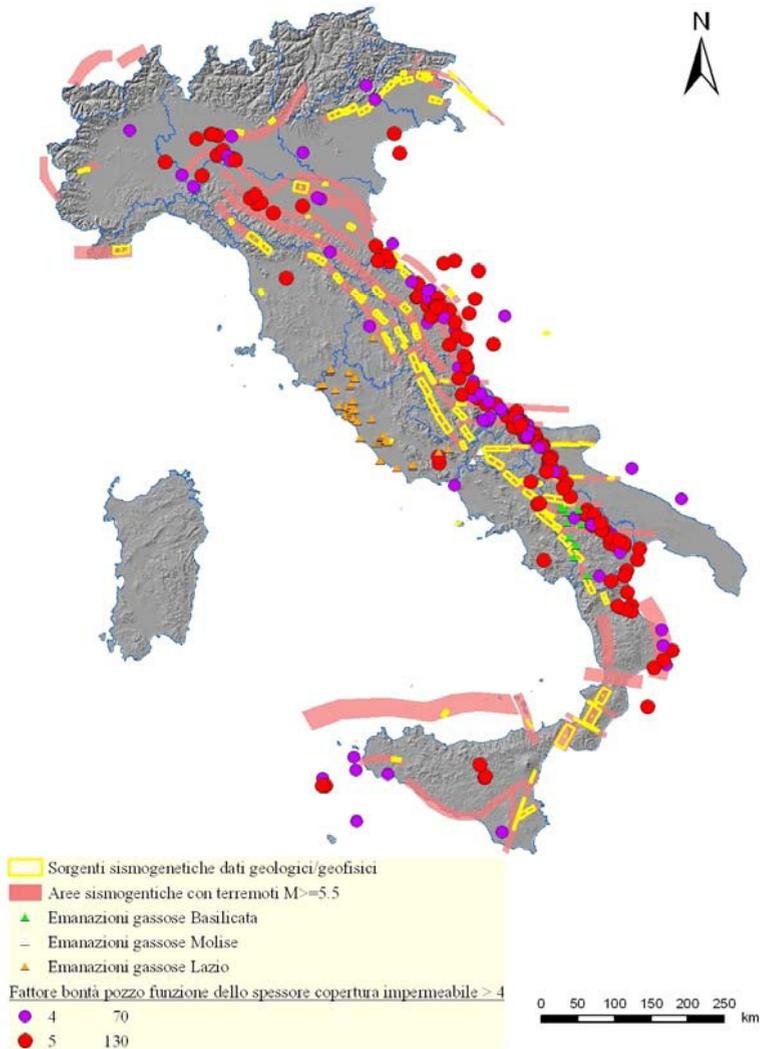
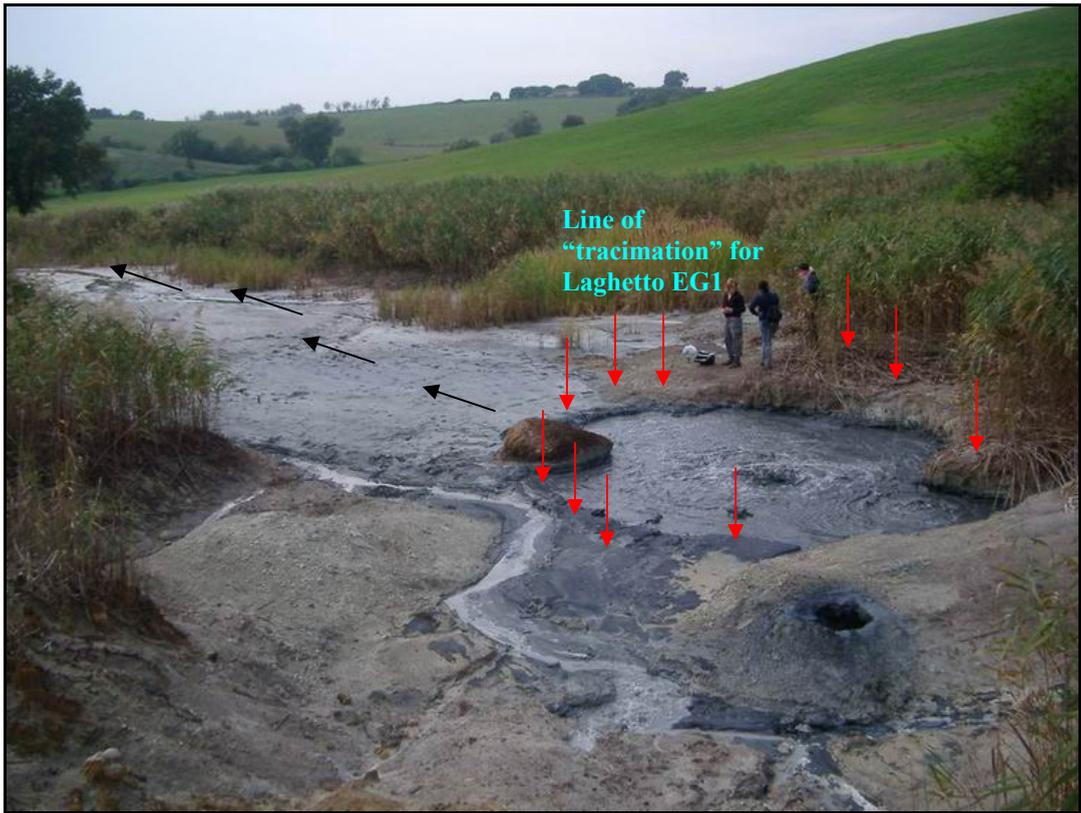


Figure 2 – Map of Italy reporting the deep wells drilled in the last 50 years (800-2000 meters) reporting also the seismicogenic structures and the active CO_2 -rich DDS (*Diffuse Degassing Structures*). Wells more deep than 2000 meters are not reported, i.e. the Matilde 1 well, studied in this period by INGV as sink for the ENEL Torrevaldaliga CO_2 source. Only the wells with “very good” caprock (factor 5, red balls) and “good” caprock (factor 4, violet balls) are reported in the figure (modified from Quattrocchi et al., 2007).

As regards the maximum risk concept for the “aquifer contamination”? We have to communicate that spark waters saturated in CO_2 are often exploited for the mineral waters production, and could be a good investment. The first advise, by discrete or continuous monitoring (see this volume, Quattrocchi et al., 2008) of a CO_2 leakage in the aquifer could be ready reported to the Competent authorities, by activating a trace metals intense monitoring as done normally for the drinkable aquifers. If there is a leakage it will be after the entire aquifer body is CO_2 saturated: more or less 100 to 500 years are necessary: these are the rates for diffusion and advection transport process to render accessible the injected CO_2 to the supergenic environment strata, including shallow drinkable aquifers.

Are these maximum risk scenarios comparable to the climate-changes catastrophic scenarios? Are these maximum risk scenarios comparable with a nuclear power failure or a wide contamination from an unsound nuclear waste geological storage sites?? Absolutely not.

The CCS scientific and industrial community is strongly helped by the concept of “solubility” and “mineral trapping” not present for the CH₄ natural gas storage. Please communicate these concepts on the newspapers, video and festivals



(a)



(b)

Fig. 3 - (a) Palidoro DDS super-pools, where the SAP (Sistema Alta Portata) was applied by the INGV team, in particular the EG 1 pool is highlighted with the red arrows. Outside the pool, the flux follows the black arrows, where a lot of died animals are normally found. (b) the SAP was now positioned on the pool, during the measurement with a hot-wire anemometer for quantify the flux rate [m/sec]. The CO₂ flux from this DDS could correspond to a 1/5 or 1/10 of the 1% leakage of a clean coal power plant injection volume (200 Millions tons in 20 years). And this could be the “maximum risk” associated to this CCS project.

5. Conclusions

The most important messages to be highlighted on CCS are mentioned and critically reviewed in the newspaper articles: this exercise is very useful and have to be discussed in dedicated appointments with the scientific journalists themselves.

Some general concept have to strongly and continuously communicated: CO₂ is not a waste, is not a poisonous gas, is simply a climate-alterant greenhouse gas, a corrosive acidic gas in pipeline/wells only if wet and it is dangerous for the health, only over a certain concentration, if take the place of atmospheric air composition, in the first strata of the soil (0-1 metre typically), being heavier of the air itself. The degassing/leakage risk could be negligible if a storage site selection was accomplished; the experience to have dealing with around 200 Diffuse Degassing Structures (DDS) in Italy, gave opportunity to INGV to manage this kind of risk very friendly with the population, mostly in volcanic and faulty-quiescent areas.

Have to pass on newspapers that any kind of soil is degassing with a baseline-background CO₂ flux (Φ_{CO_2}) of around 10-100 [gm⁻²day⁻¹], while the threshold for possible danger for human health is in the order of magnitude of 10000-50000 [gm⁻²day⁻¹]: but before to reach this flux the shallow aquifer are to be “saturated” in CO₂ and a lot of signatures are present in the soils: a process very slow that could be easily monitored and forecast. All the monitoring protocols are ready, tested by INGV since long time for the Italian Civil Protection Department to alert in short time throughout the Italian territory. Any year, 800 peopled die due to car accidents, only 10 people died in the last century in Italy caused by un-forecasted degassing episodes. This in Italy, elsewhere less and less.

The vantage with respect to the Natural Gas (CH₄) underground storage is that CO₂ is reactive, despite at the same time different behaviour is found as concerns the leaking/sealing power of this oxyded carbon component: these concept are to be discussed and explained to the people, dealing and friendly with the natural gas storage and pipelines. Also the fact that the geological structures hosting CO₂ (i.e. an anticline with good and thick caprock) are more safe than those containing natural gas, because we have to add and consider more than the physical-hydrodynamic trapping also the solubility trapping and mineral trapping. The general public is able to understand these general concepts concerning the different trapping mechanisms and any delay in explaining these basic and simple concepts could be fatal in creating panic when the CO₂ geological storage sites are “imposed” and not “proposed” during the course of the feasibility studies themselves, rendering the NGO participant to the road map of the sites selection.

Acknowledgements: Thank to the Civil Protection Department (DPC) to fund the “*Diffuse Degassing in Italy*” Project (2005-2007 DPC Project V5) and to fund the “*Research on active volcanoes, precursors, scenarios, hazard, and risks*” Project (2005-2007 DPC Project V3). Thank to the INGV Scientific Divulagation office head, Dott. Giuliana D’Addezio, to the people within the UF 3 “*Fluid Geochemistry, Geological Storage and Geothermics*” of Section Rome 1-INGV, and in particular to Alessandro Carosi.

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