



Comparison of CO₂ leakage and monitoring strategies in a CH₄ storage site, geothermal site, CO₂ storage site and seismically activated-CO₂ rich analogue

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Abstract

The INGV (Istituto Nazionale di Geofisica e Vulcanologia), started on 29/9/99, n. 381 Decretation, and born in 2001 following the merging of 5 old institutions: the Istituto Nazionale di Geofisica (ING), promoted by Prof. Guglielmo Marconi on 1936, the Osservatorio Vesuviano (OV) seated in Naples and three institutes of CNR: the Istituto per la Ricerca sul Rischio Sismico, seated in Milano, the Istituto per la Geochimica dei Fluidi, seated in Palermo, and the Istituto Internazionale di Vulcanologia, seated in Catania. At the moment more than 800 employees are located both as permanent staff and not, including technician and administrative people. In particular, at the moment INGV has 524 permanent staff people, 302 people with a Contract, 129 people among fellowship, PhD and Co.co.co, etc... INGV has a financial budget of 90 Millions €/year among which 30 Millions are gathered by free market competition in research, both national and international. INGV gathered at least 50 Millions € permanent technologies mostly as geophysical and geochemical on-line networks, linked to the Civil Protection Department main seat. INGV accomplishes a 24 h on-line monitoring of the Italian territory as regards the seismic and volcanic/natural degassing-leakage risks (tremors), by alerting in few minutes the Civil Protection Department operative room. Other areas (es. Quiescent volcanoes, fault zones) are monitored discretely.

Relevant expertise useful for CCS projects too:

Actually INGV is dealing with a lot of competencies splitted in seismology, seismic risk, geodynamics, paleo-seismology, structural geology, remote-sensing, geomechanics, volcanology, geophysical and geochemical on-line monitoring, CO₂ storage and CO₂ analogues studies, Diffuse Degassing Studies, Geomagnetism, aeronomy, Environment, operative oceanography, dynamic climatology, global warming, Antarctic research. Recently INGV was very positively appreciated by the CIVR having obtained important prizes at international level (see the web site http://vfr2006.cineca.it/php4/vfr_rel_civr_menu_x_area.php?info), also due to a huge number of international high level published papers (<http://sciencewatch.com/index/08/08/1-INGV/>). INGV, being the biggest European institute officially dedicated to the geophysical and geochemical monitoring of the so called "CO₂ analogues", with yet installed hundreds of on-line stations funded by the Civil Protection Department, was involved starting from 2000, in the biggest CO₂ storage project in Weyburn (Canada). Since that time INGV is the main promoting research institute for CCS (CO₂ Capture & Storage) in Italy, starting a lot of national and international projects (i.e. ENEL S.p.A., ENI S.p.A., Edison S.p.A., Independent Resources plc, Rezia Energia S.p.A., Carbusulcis S.p.A., CESI Ricerca (ERSE) S.p.A., SARAS Refineries S.p.A., etc...). A specific group is dedicated to CCS projects: the Functional Units "Fluid Geochemistry, Geological Storage and Geothermics".

Monitoring of GreenHouse Gases (CO₂, CH₄)
INGV maximum experience in Europe: more than 200 stations on-line

INGV: same monitoring techniques for natural CO₂ and antropogenic-industrial CO₂ injected underground !!!!

Etna
INGV station on Etna
Panarea

GMS Objective
to realise the more multiparametric and versatile continuous monitoring system for mixed networks groundwater and soil gases fluxes and concentration

GMS 3
Geochemical Monitoring System 3

GMS 2
Geochemical Monitoring System 2

GMS 1
Geochemical Monitoring System 1

1990 1997 2007

sampled sensors instruments
FIRB PHAC B6
Sub-project
F. Quattrocchi PM

Performances of the geochemical stations

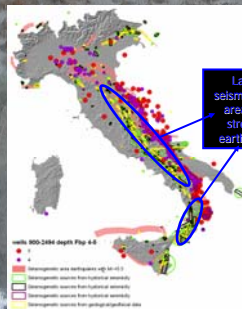
Geochemical Monitoring Network (GMS 2-GMS 3) and sites selection from this study

The CO₂ is the most "natural" gas existing underground and forming new rocks: carbonates building up Apennines and part of Alps: billions tons. CO₂ are underground and around 300 DDS at surface



- Main part of "Diffuse Degassing Structures" (DDS) are located along the Tyrrhenian margin;
- DDS for Civil Protection Department ...
- since Ancient Roman times only a few diseased occurred
- Mostly H₂S component is dangerous and poisonous

F₃ Projection on a GIS platform - comparison with INGV DISS (Database of Individual Seismogenetic Sources)



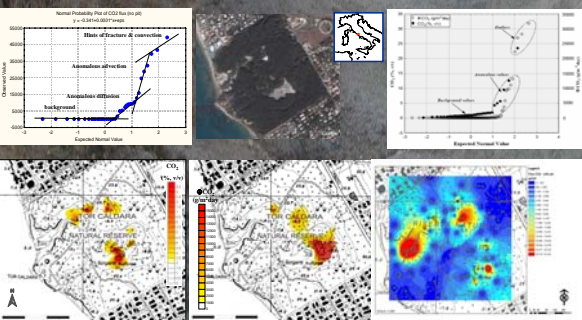
- Identifying possible areas for geological storage...
- Necessary to consider only areas with:
- ✓ Good Cap-rock (F₀₅ 4-5)
 - ✓ deep aquifer
 - ✓ DISTANCE FROM SEISMOGENETIC SOURCES

Communication Strategy:
all the underground uses together to pass "awareness" to people

Concept to public awareness: natural flux of CO₂

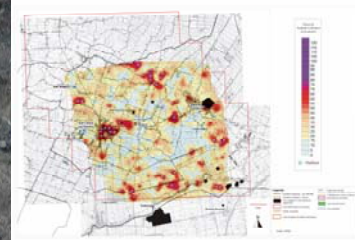
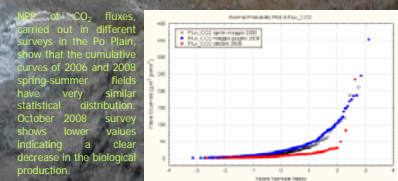
The Tor Caldara area (Rome, Latium)

The Tor Caldara area has been investigated during June, 2007 in the frame of "Diffuse Degassing in Italy" risk assessment project (funded by the Civil Protection Department)



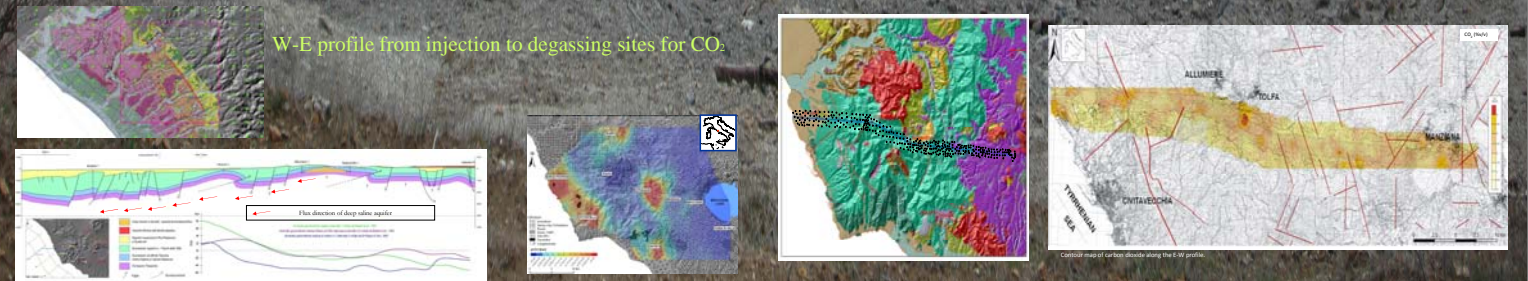
F₀₅ shows a more diffusive distributed directly linked to diffuse degassing structures

Geochemical survey for a natural gas storage site



Contour map elaborated on 95% of total population. Outliers are shows with the classed post. Maximum value of CO₂ is 353 g/m²day

W-E profile from injection to degassing sites for CO₂



CO₂ mass flow Carbon dioxide along the W-E profile