**Description of the infrastructure**

<table>
<thead>
<tr>
<th>Name(s) of the infrastructure(s)*:</th>
<th>Panarea Nat Lab</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location (town, country):</td>
<td>Panarea – Aeolian Archipelago (ME), Italy</td>
</tr>
<tr>
<td>Website:</td>
<td><a href="http://www.ogs.trieste.it">www.ogs.trieste.it</a></td>
</tr>
<tr>
<td><strong>Legal name of organisation operating the infrastructure:</strong></td>
<td>OGS (Istituto Nazionale di Oceanografia e di Geofisica Sperimentale)</td>
</tr>
<tr>
<td>Location of organisation (town, country):</td>
<td>Sgonico (TS), Italy</td>
</tr>
<tr>
<td>Infrastructure Contact (i.e. name, email of primary contact)</td>
<td>Cinzia De Vittor, <a href="mailto:cdevittor@ogs.trieste.it">cdevittor@ogs.trieste.it</a></td>
</tr>
<tr>
<td>RICC Contact (i.e. name, email of secondary contact)</td>
<td>Michela Vellico, <a href="mailto:mvellico@ogs.trieste.it">mvellico@ogs.trieste.it</a></td>
</tr>
</tbody>
</table>

*Infrastructure (s): means a facility, a resource (or a coherent set of them) together with the related services that are used by the scientific community to conduct research.

**Installation:** is a part of an infrastructure that could be used independently from the rest.

**Description of the facilities**

Panarea is a natural laboratory where thermo-magmatic CO$_2$ is leaking at substantial rates from the seafloor at water depths ranging from 5 to 30 m. The majority of this CO$_2$ is released in an area between two islets located 3 km to the east of Panarea (Lisca Bianca and Bottaro). This natural CO$_2$-release field (c. 3 km$^2$) has been active for centuries, with gas emanating from a series of NW-SE and NE-SW trending fractures (Fig.1).

This natural laboratory provides the opportunity to study gas migration in different structural and geological settings. It can be used to study the ascent of CO$_2$ through sedimentary strata, to decipher the dynamics of gas bubble and droplet plumes, to understand the impact of CO$_2$ on benthic organisms and marine ecosystems, and to test and improve CO$_2$ monitoring techniques.

![Figure 1. Panarea natural laboratory.](image)

Due to the unique characteristics of this site, the Italian Ministry of University and Research (MIUR) financed the setting up of a permanent laboratory, which offers logistical and scientific support to the researchers utilising the site.

This laboratory (ECCSEL Nat Lab-Italy) is a component of the ECCSEL (European Carbon Dioxide Capture
State of the Art, uniqueness (if applicable), and any specific advantages (e.g. technical, economic etc)

In the early 1980’s researchers began to conduct gas geochemistry surveys of the area showing that the system was relatively stable in both gas chemistry (e.g. 98% CO₂, 1.7% H₂S plus other trace gases) and flux rates (7.9 x 10⁶ l/d). On November 2 and 3, 2002, a gas outburst event increased the total gas flow rate by about 2 orders of magnitude (4 x 10⁸ l/d), with large volumes of gas reaching the water surface. Flux rates began to decrease towards pre-outburst conditions about 3 months after the event. The majority of fluid release points are gas only, although various points also release water of different origin, ranging from geothermal to seawater end-members that are mixed to variable degrees.

Based on the range of depths and relatively high and persistent gas flow rates, the occurrence of both gas only and gas-water seepage, and its close proximity to shore, Panarea represents an exceptional location to study natural processes and impacts related to shallow seabed CO₂ leakage.

This site has been studied in the framework of several European projects with an integrated physical chemical, biological approach for a more complete (and realistic) understanding of the possible consequences of a leak from a CO₂ storage site into the overlying water column.

Scientific environment (related and potentially available scientific and technical services at RI's location e.g. analysis, material preparation etc.)

OGS is the responsible of this infrastructure and in collaboration with other research institutes and universities (such as the University of Rome, La Sapienza), manages the permanent laboratory, making available the long-term series of multidisciplinary data collected at Panarea and offering logistical and scientific support to the researchers utilising the site.

The on land installation (Fig.2) is close to the loading wharf and contains about 90 mq of laboratory space, which are fitted out for general-purpose and dedicated use, and several outside open spaces that can accommodate a variety of shifting needs and equipment. Scientists also have access to a well-equipped computer and electronics lab. The on land installation will also be equipped to maintain, calibrate and real time connect the permanent sensor network, which will be installed in correspondence of the natural CO₂ leakages.

A diving centre is present in the same building offering small boat service for offshore work and professional staff with experience in scientific underwater activities.
CCS PROJECTS:

EU-funded CCS projects:
CO2GeoNet, ECO2, RISCS

Other CCS projects: (National)
CO2Monitor, ECCSELNat-Lab Italy

Main/major non-CCS projects:
EUROFLEETS

Patents:

Selected publications:

1. Beaubien S.E., De Vittor C., Viezzoli D., Annunziatellis A., Bigi S., Celussi M., Colella S., Comici C.,
   Laboratory for Offshore CO2 Leakage Monitoring and Impact Studies” Fourth EAGE CO2 Geological
   Storage Workshop, Demonstrating storage integrity and building confidence in CCS, 23 - 25 April
   2014, Stavanger, Norway: 19675.
   Monitoring Near Panarea Island (Italy) Using Multiple Low-Cost GasPro Sensors.” Environ Sci
   bacterioplankton in a shallow CO2-dominated hydrothermal vent (Panarea Island, Tyrrhenian sea)”.
   Estuar Coast Shelf Sci 97:10-18.
4. McGinnis D., Beaubien S.E., Bigalke N., Bryant L.D., Celussi M., Comici C., De Vittor C., Feldens P.,
   impact of the leaking gas (PaCO2)”; R/V URANIA, Cruise No. U10/2011, 27 July – 01 August 2011,
   DOI 10.3289/CR_ECO2_19835.
5. De Vittor C., Del Negro P., Paoli A., Falconi C., Celussi M., Cataletto B., Comici C., Fabbro C.,
   marine microbial assemblage”. First EAGE CO2 Geological Storage Workshop, 29-30 September

FACILITY AVAILABILITY:

Unit of access:
campaign

Availability per year:
4 campaigns

Expected duration of single experiment:
5 days + 2 travel days

OPERATIONAL OR OTHER CONSTRAINTS:

Specific risks:
Weather conditions may impact on the work schedule. In case of rough sea it is not possible to perform any sea
survey or sampling. Please consider this when planning your campaign.
During the summer time it is not possible to park a car in the island. In case you have to transport working equipment, you have to ship it.

**Legal issues:**