

## What's New

# Japan CCS exhibited at Hokkaido Government Office on June 10 and 11.

Venue: Lobby on the 1<sup>st</sup> floor of Hokkaido Government Head Office  
(Public Relations Corner for Hokkaido Government).



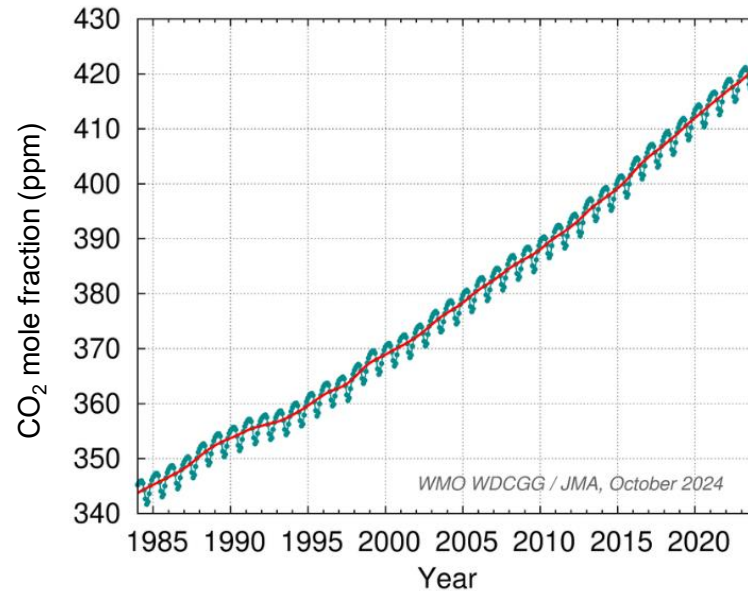
Visitors, including Hokkaido government officials, stopped by to listen to the explanations.

1/19

# Carbon dioxide (CO<sub>2</sub>) is the most significant greenhouse gas contributing to global warming

## ● Time-series representation of Globally Averaged CO<sub>2</sub> Mole Fractions

The global mean annual atmospheric CO<sub>2</sub> mole fraction was 420.0 ppm in 2023, an increase of 2.3 ppm from the previous year. This is 51% higher than the pre-industrial level (about 278 ppm).



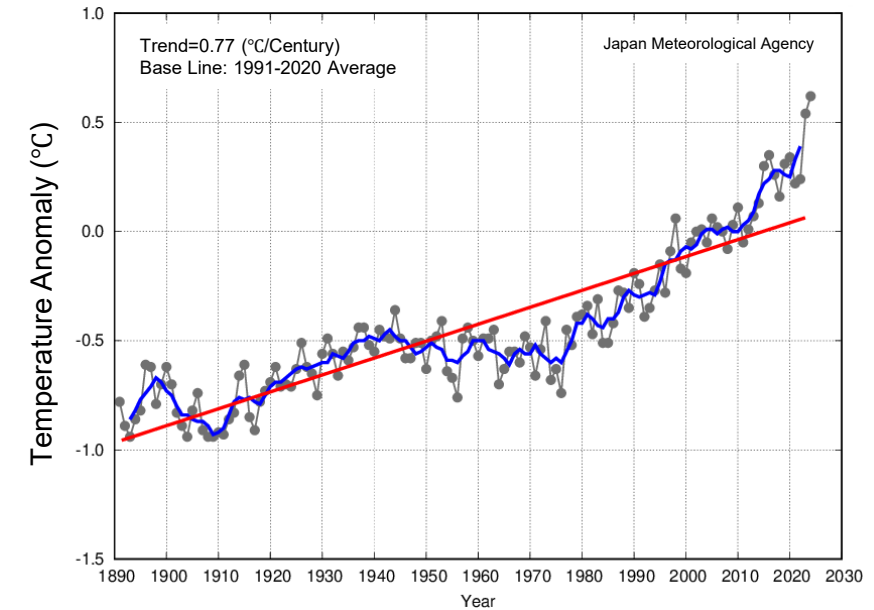
Blue: monthly mean concentration

Red: monthly mean with seasonal variations removed

Source: Japan Meteorological Agency "Globally averaged mole fractions" (updated on March 25, 2025); as modified by Japan CCS Co., Ltd. [https://www.data.jma.go.jp/ghg/kanshi/ghgp/co2\\_e.html](https://www.data.jma.go.jp/ghg/kanshi/ghgp/co2_e.html)

## ● Annual anomalies of Global Average Surface Temperature

The global average surface temperature is rising while repeatedly experiencing various fluctuations. In particular, since the mid-1990s, there has been an increasing number of years with high temperatures.



Black thin line: surface temperature anomaly of each year

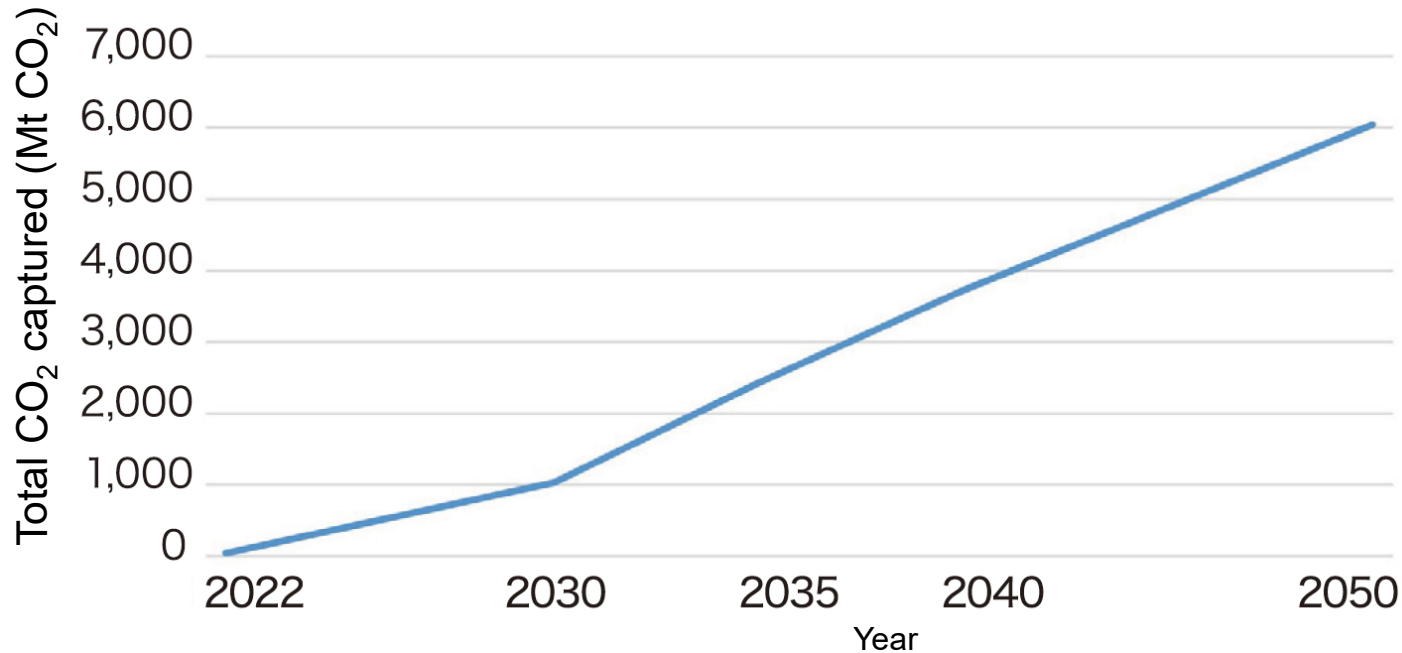
Blue line: 5-year running mean

Red line: long-term linear trend

Source: Japan Meteorological Agency "Global Average Surface Temperature Anomalies"; as modified by Japan CCS Co., Ltd. [https://www.data.jma.go.jp/tcc/tcc/products/gwp/temp/ann\\_wld.html](https://www.data.jma.go.jp/tcc/tcc/products/gwp/temp/ann_wld.html)

# Potential of CO<sub>2</sub> reduction by CCUS

■ CO<sub>2</sub> capture amount based on Net Zero Emissions by 2050 Scenario (NZE Scenario)



According to the IEA (International Energy Agency), to achieve net zero by 2050, the amount of CO<sub>2</sub> that will need to be captured globally by CCUS is estimated to be approximately 6 billion tonnes per year at that point.

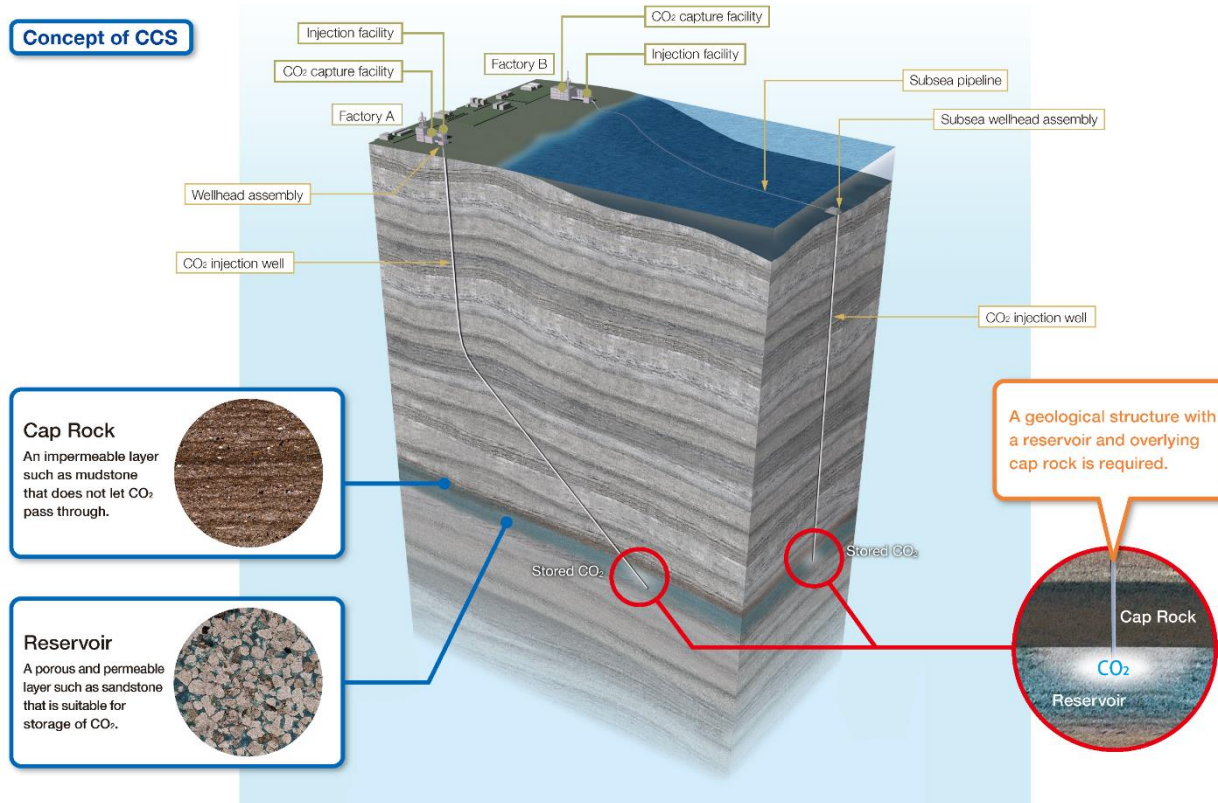
Source: IEA Net Zero Roadmap 2023 "Table A. 4: World CO<sub>2</sub> emissions"; as modified by Japan CCS Co., Ltd.



# What is CCS?

## Carbon dioxide Capture and Storage

### Concept of CCS



CCS is a technology to prevent carbon dioxide (CO<sub>2</sub>) emitted by facilities such as power plants and factories from being released into the atmosphere. The technology involves capturing the CO<sub>2</sub>, injecting it into subsurface geological formations and storing it permanently. Along with energy efficiency and renewable energy, CCS is a key countermeasure against global warming.

# How to store CO<sub>2</sub>



## ■ Features of Caprock

Mudstone etc., made of fine mud grains

- Impervious
- Sufficient blocking ability
- Covering reservoir layer widely and thickly

## ■ Features of Reservoir

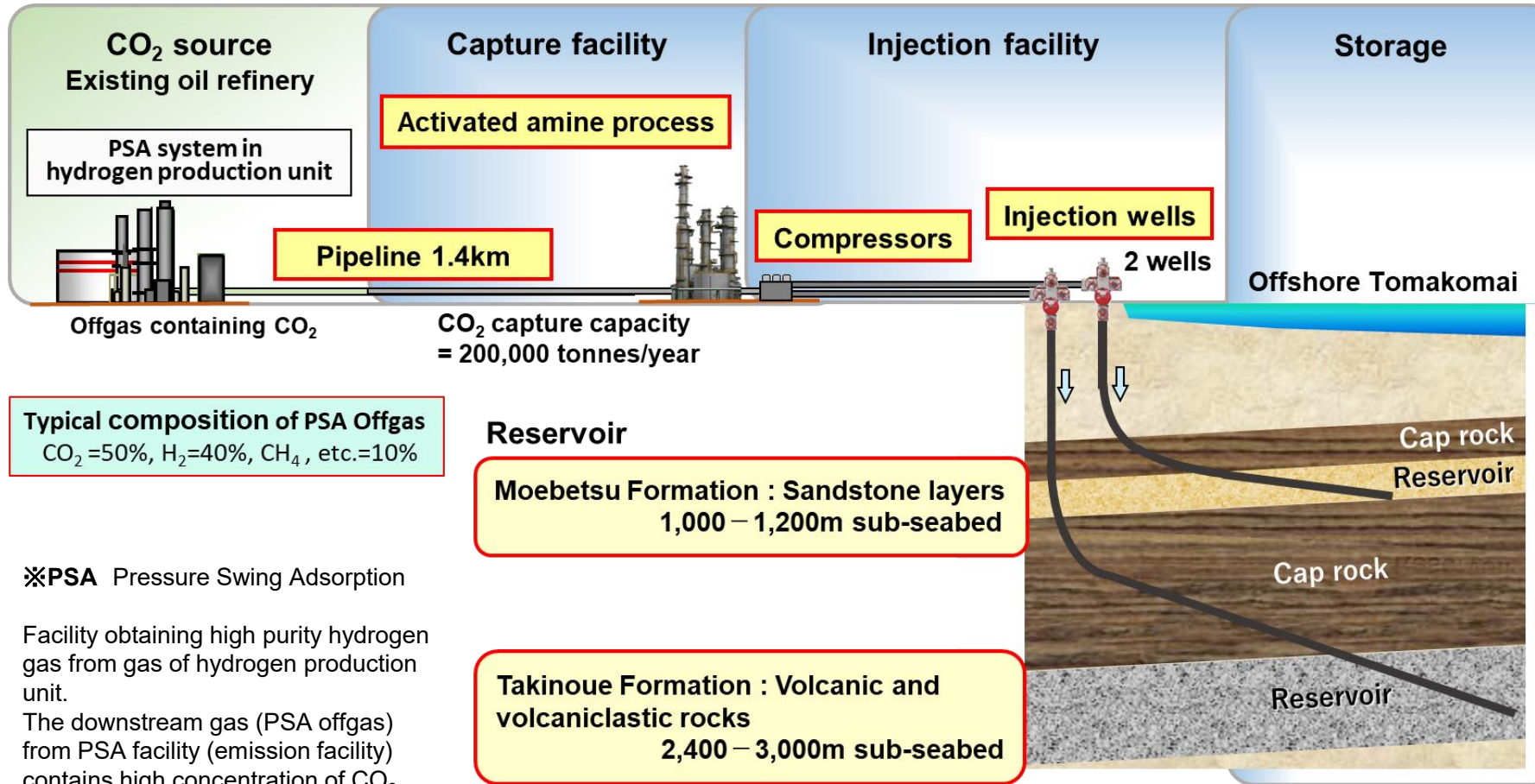
Sandstone, volcanic rock, etc., made of coarse grains

- Sufficient pore spaces to store CO<sub>2</sub>
- Pervious

In order to store CO<sub>2</sub> in the subsurface under the seabed, a geological structure where a reservoir is overlain by a cap rock is required. The cap rock blocks the leakage of injected CO<sub>2</sub> from the reservoir.



# Flow Scheme of Tomakomai Demonstration Project



CO<sub>2</sub> is captured from offgas containing CO<sub>2</sub> generated by a hydrogen production unit of a refinery, pressurized (up to 23 MPa) to the pressure required for injection, injected at a scale of about 100,000 tonnes of CO<sub>2</sub> per year and stored in two sub-seabed reservoirs offshore Tomakomai.

# Schedule of Tomakomai Demonstration Project (from JFY2012 -)

**Contract Period: From JFY2012 to JFY2026**

■ From JFY2012 to JFY2015: Preparation

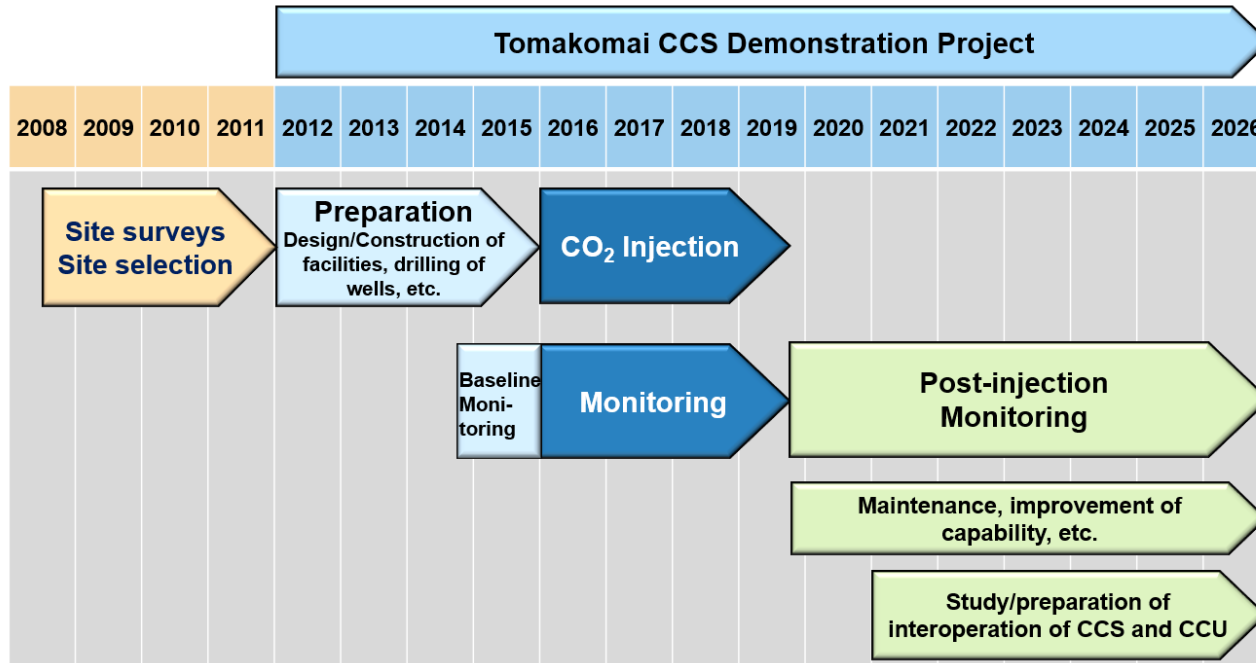
Activities including the design and construction of facilities, drilling of wells, and preparation for demonstration operation were carried out.

■ From April 2016 to November 2019: CO<sub>2</sub> injection (On November 22, 2019, the target of 300 thousand tonnes of CO<sub>2</sub> injection was achieved, and injection was terminated.)

■ From JFY2016: Monitoring of CO<sub>2</sub>(\*) ; being continued.

■ From November 2019: Maintenance of facilities, improvement of capability, etc.

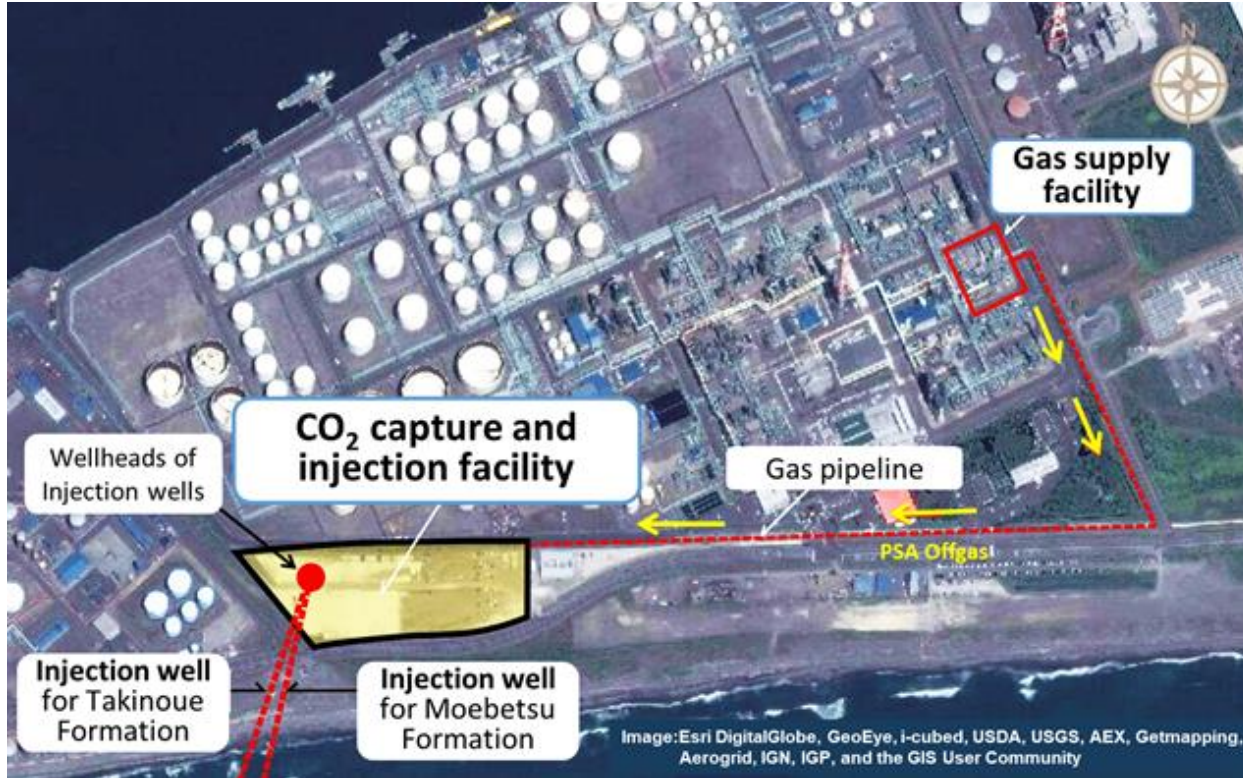
■ From JFY2021: Study/preparation of the interoperation of CCS and CCU



(\*) Monitoring the behavior (migration, distribution) of the injected CO<sub>2</sub>, continuous monitoring of micro-seismicity and natural earthquakes, marine environmental monitoring to detect for possible CO<sub>2</sub> leakage/seepage are being conducted.

※Years are Japanese Fiscal Years (April to March)

## Positional Relation of Onshore Facilities

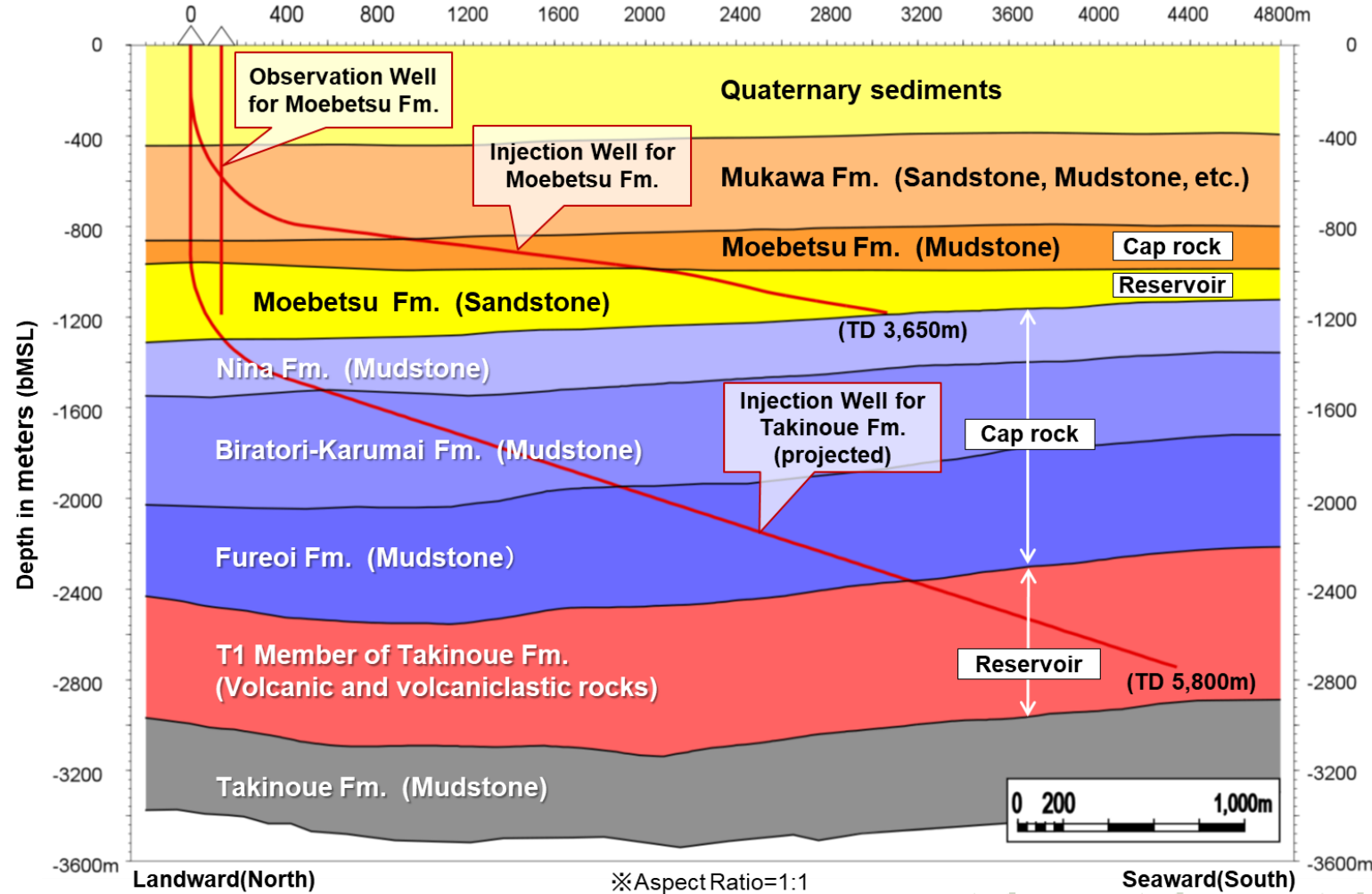


In the "Gas supply facility", PSA offgas (CO<sub>2</sub> containing gas) is generated in the hydrogen production process of the refinery and sent to the Tomakomai Project "CO<sub>2</sub> capture and injection facility" via a 1.4 km gas pipeline.

At the "CO<sub>2</sub> capture and injection facility", CO<sub>2</sub> is captured at purity of 99% or more from the PSA offgas sent through the Gas pipeline, pressurized by compressors, and injected by 2 injection wells into offshore sub-seabed reservoirs for storage.



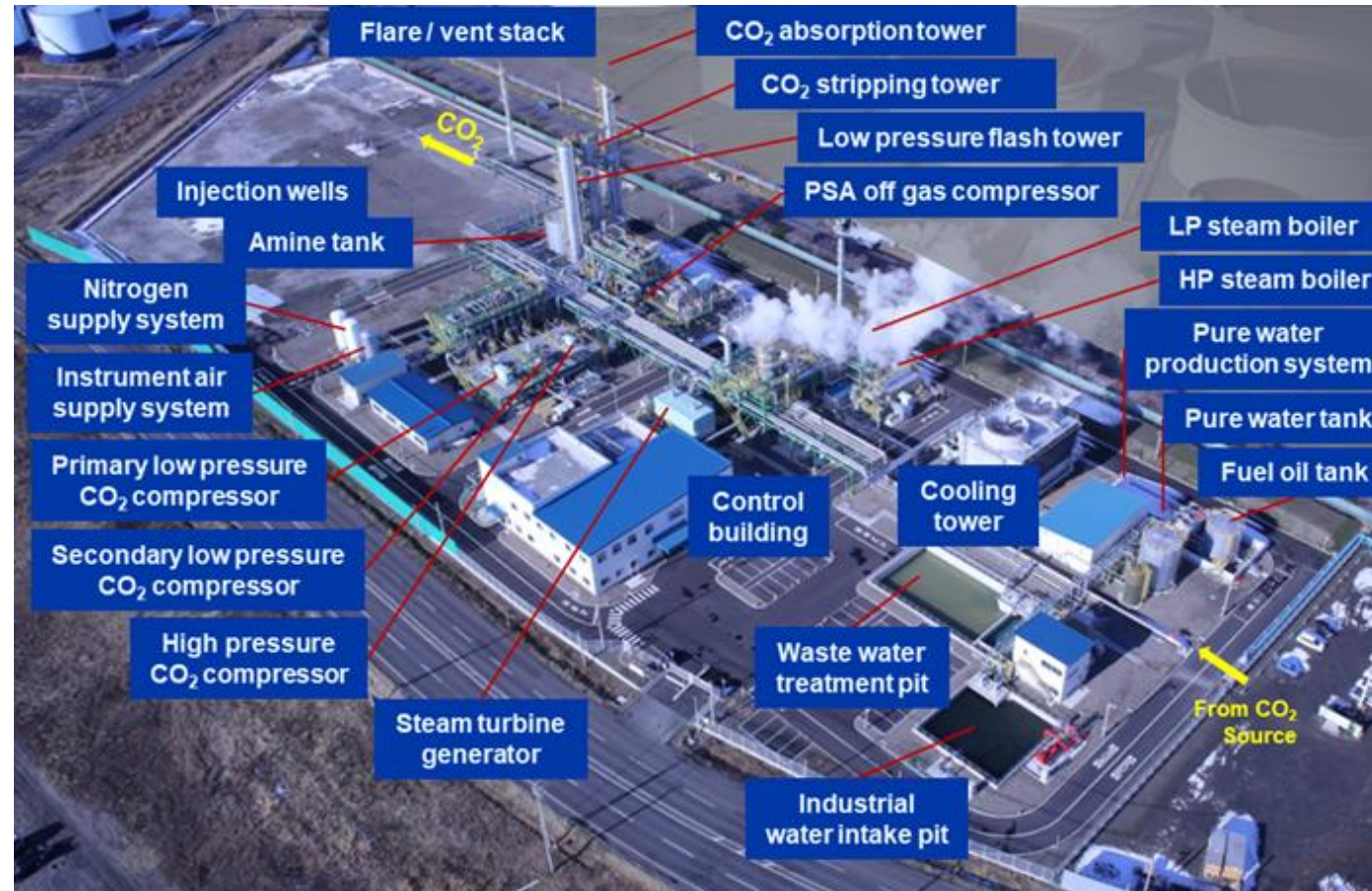
# Schematic Geological Section



This is a schematic geological section showing how the CO<sub>2</sub> is injected by two injection wells extending to the two reservoirs, the Takinoue Formation T1 Member (volcanic rocks) and Moebetsu Formation (sandstone).

The Takinoue Formation injection well is a directional well with a total depth of 5,800m and maximum inclination of 72 degrees. The Moebetsu Formation injection well is a directional well with a total depth of 3,650m and maximum inclination of 83 degrees.

# Bird's Eye View of Capture and Injection Facilities





# CO<sub>2</sub> Capture Facilities and Compressors



## 3 stage CO<sub>2</sub> Compressors

Increases pressure  
of captured CO<sub>2</sub> to  
the pressure  
required for injection

CO<sub>2</sub> Capture Facility  
Captures CO<sub>2</sub> from PSA  
Offgas



# CO<sub>2</sub> Injection Report

Injection was terminated on November 22, 2019.

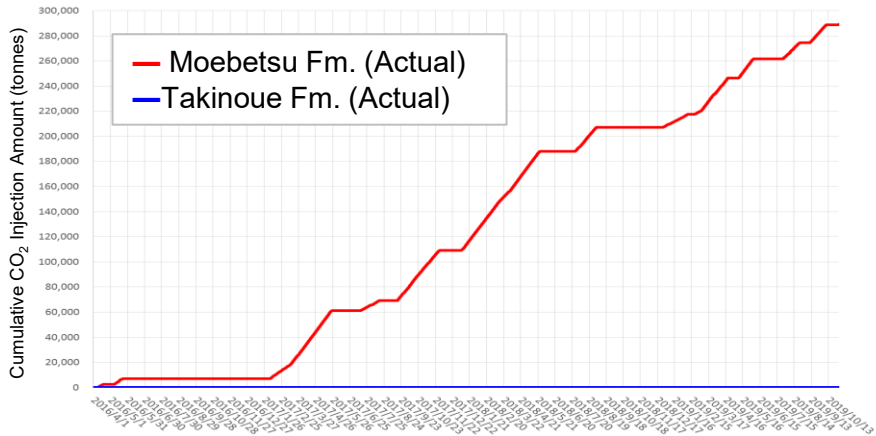
Cumulative CO<sub>2</sub> Injection amount  
(April 06, 2016~November 22, 2019)

**300,110.3**  
tonnes

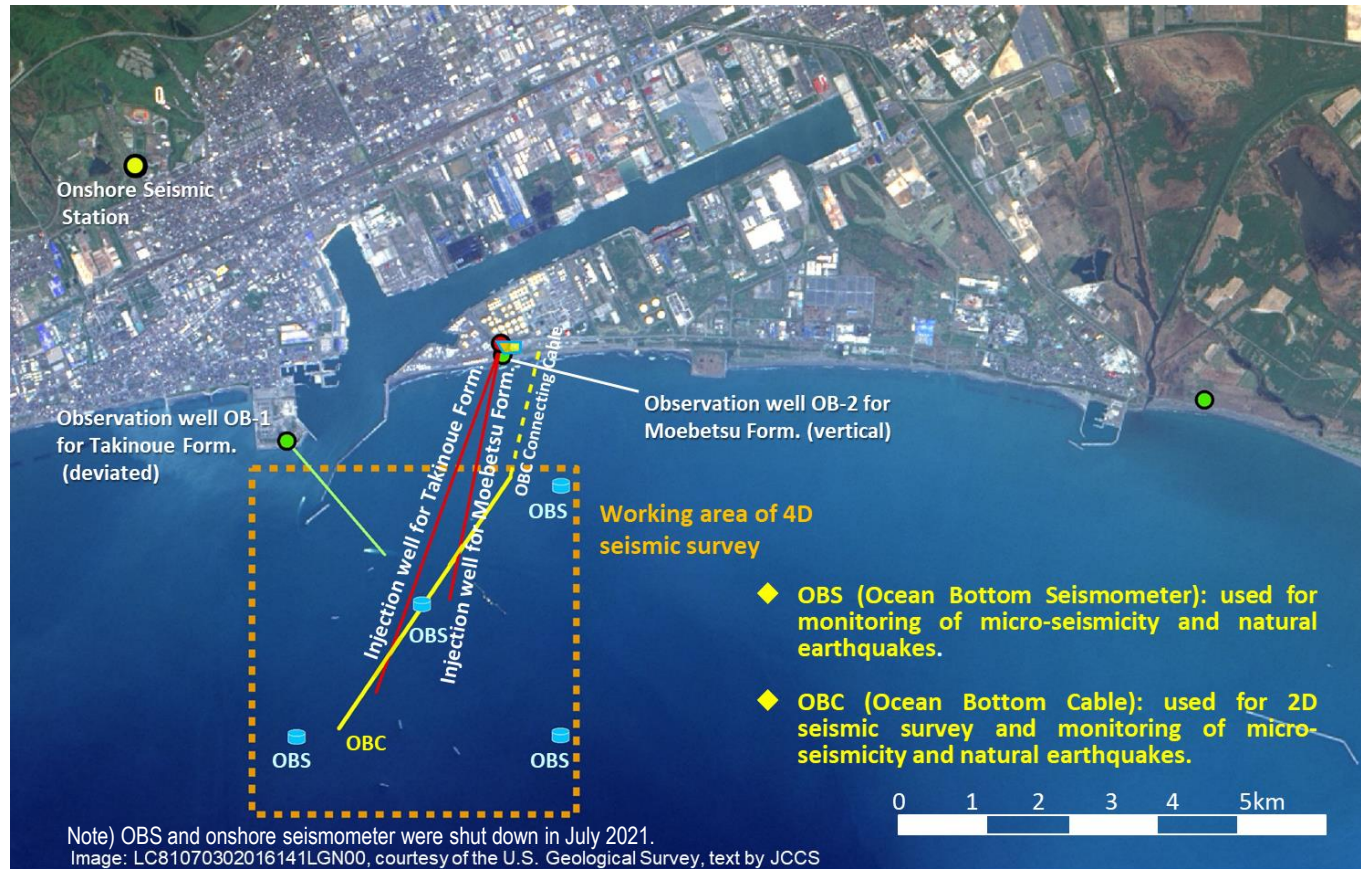
Injection Amount in November 2019

	Injection Amount/month (November 2019)	Cumulative CO <sub>2</sub> Injection Amount (As of November 22)
Moebetsu Fm.	10,793.5 tonnes	300,012.2 tonnes
Takinoue Fm.	0.0 tonnes	98.2 tonnes

Change of cumulative CO<sub>2</sub> Injection Amount



# Layout of Monitoring Network

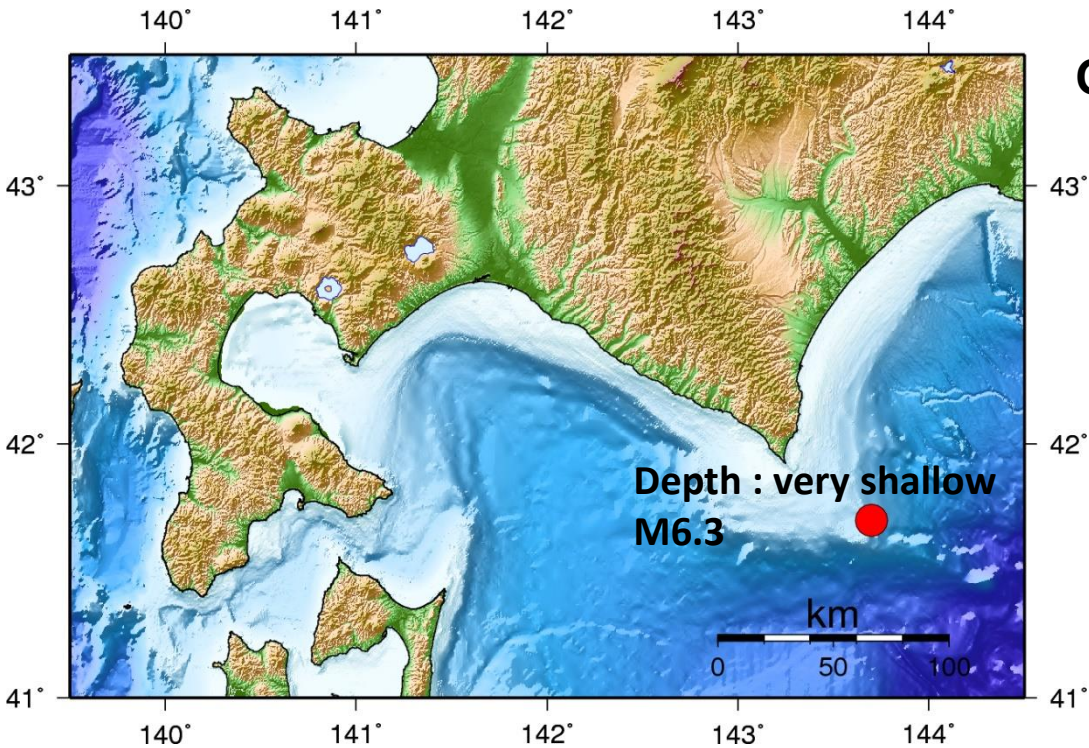


A monitoring network was constructed near and around the CO<sub>2</sub> injection point, and continuous monitoring over six years comprising before CO<sub>2</sub> injection (1 year), during CO<sub>2</sub> injection (3 years) and after termination of injection (over 6 years) is being carried out.

- The formation pressures and temperatures of the wells - observation wells (3 wells) drilled around the CO<sub>2</sub> injection point and CO<sub>2</sub> injection wells (2 wells) are being monitored.
- Seismometers were installed in the observation well and on the seabed to monitor earthquakes (including micro-seismicity - minute tremors that cannot be felt by humans).
- Observed data is controlled centrally at the Tomakomai Demonstration Center and constant monitoring for the presence of abnormal conditions is carried out.

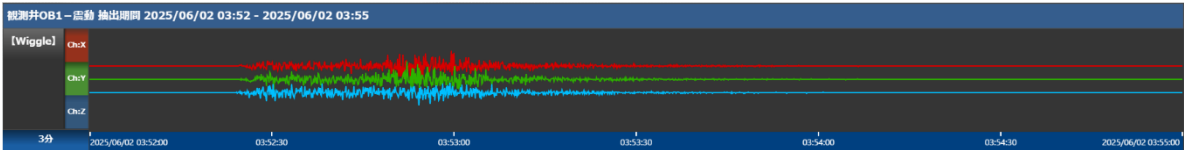


# Most recent perceptible earthquake observed in Tomakomai



Geomorphic map is prepared from Geographical Survey Institute numerical map 250 m mesh (altitude) and Japan Marine Safety Agency 'Japan Oceanographic Data Center' 500 m mesh water depth data

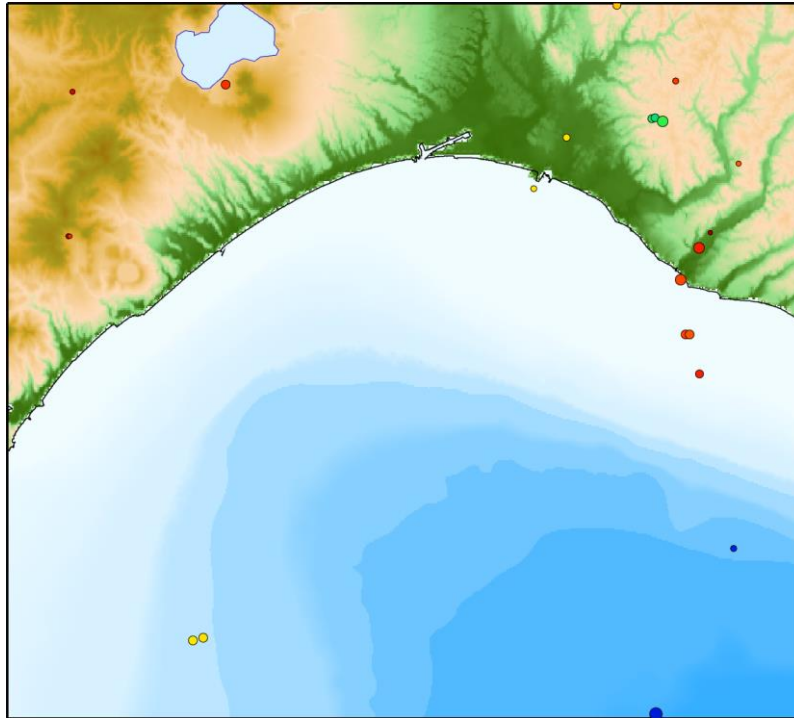
## Observation record of Seismometer in Observation Well



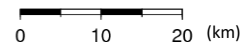
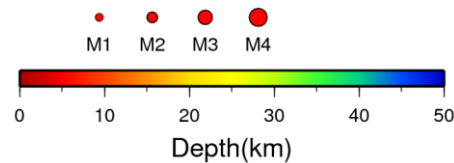
Earthquake Information Announced by the Japan Meteorological Agency	
Time & Date	3:52 (JST) 2 Jun, 2025
Hypocenter	Lat. 41° 42'N Lon. 143° 42'E Depth very shallow
Magnitude	6.3
Seismic Intensity at Tomakomai-city	2



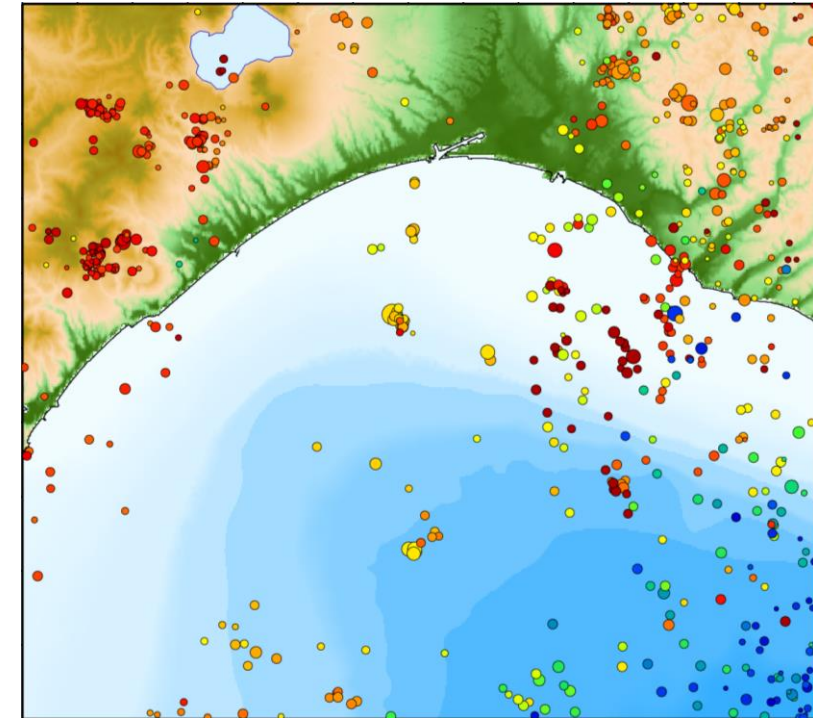
# Distribution of Natural Earthquakes around Tomakomai



Natural earthquake hypocenter distribution in May 2025



Geomorphic map is prepared from Geographical Survey Institute numerical map 250 m mesh (altitude) and Japan Marine Safety Agency 'Japan Oceanographic Data Center' 500 m mesh water depth data

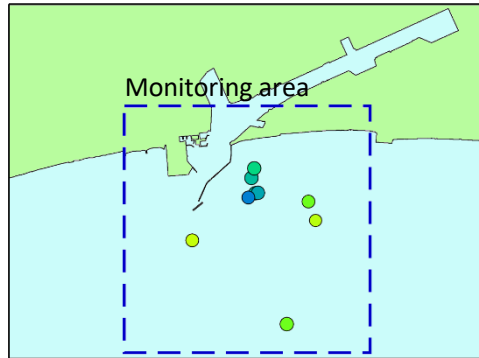


Natural earthquake hypocenter distribution occurred from 2001 to 2010

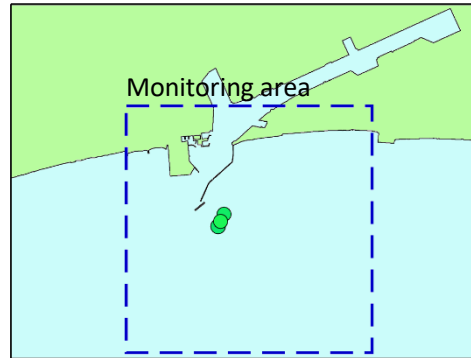
The hypocenters in the figure is from the JMA Unified Hypocenter Catalog.  
Earthquakes with the hypocenter depth of 50 km or less are displayed.

# Micro-seismic events nearby injection point

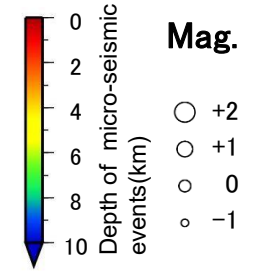
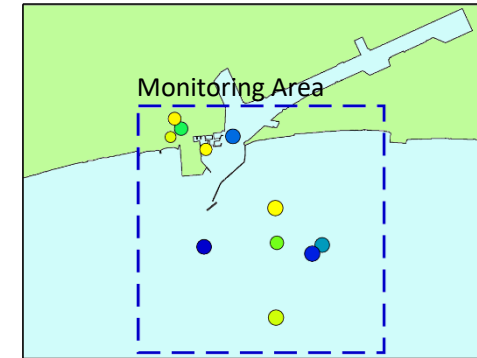
Pre-injection events (2015/2/1-2016/4/5)



Events during CO<sub>2</sub> injection (2016/4/6-2019/11/22)

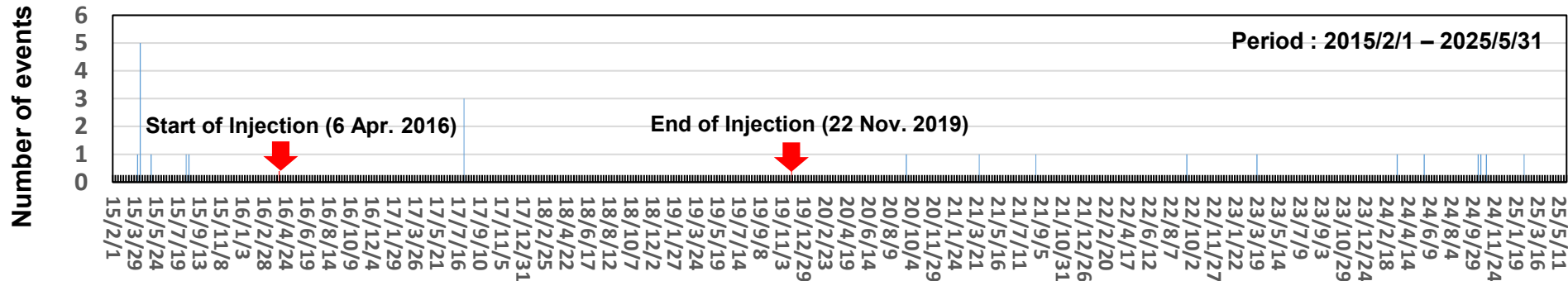


Post-injection events (2019/11/23-2025/5/31)



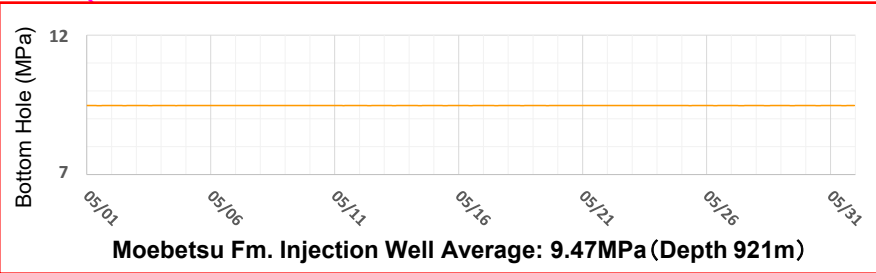
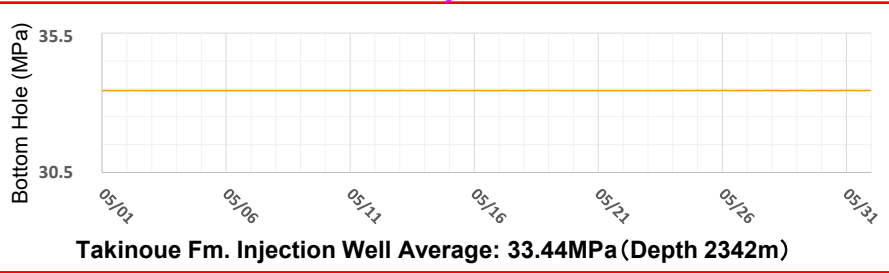
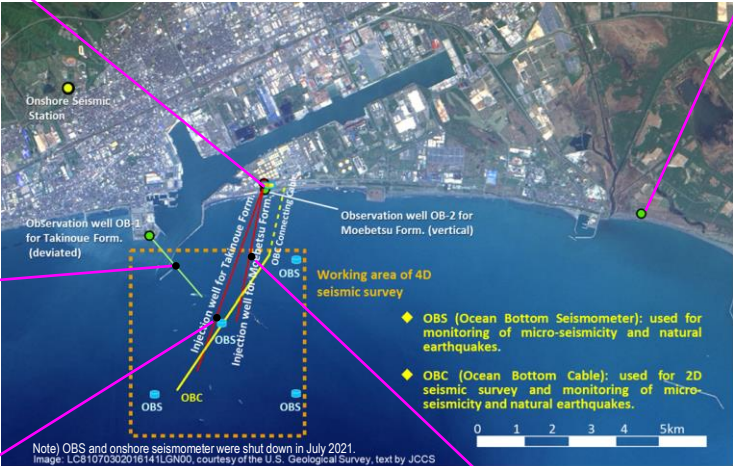
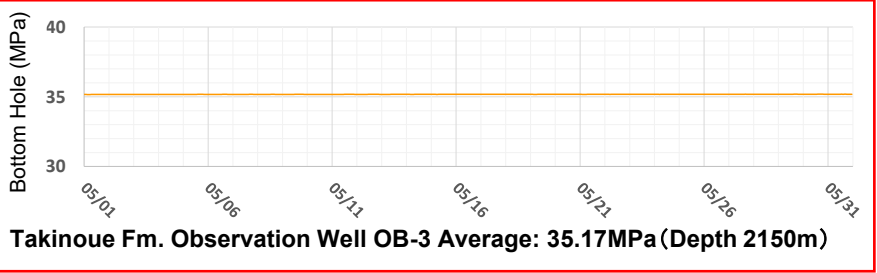
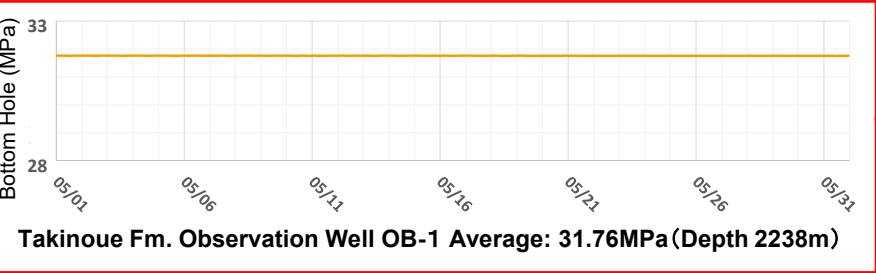
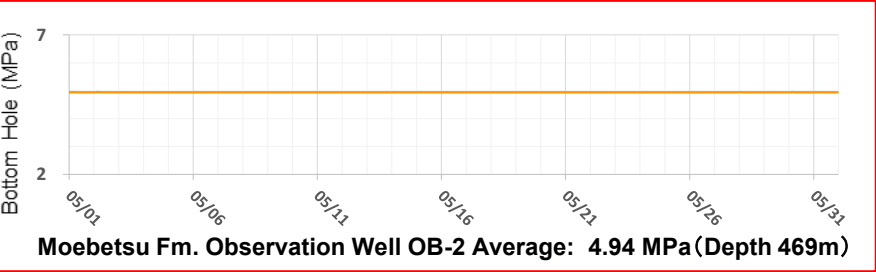
The left map is created based on the base map Information coastline data of Geospatial Information Authority of Japan.

Detection of micro-seismic events (weekly)



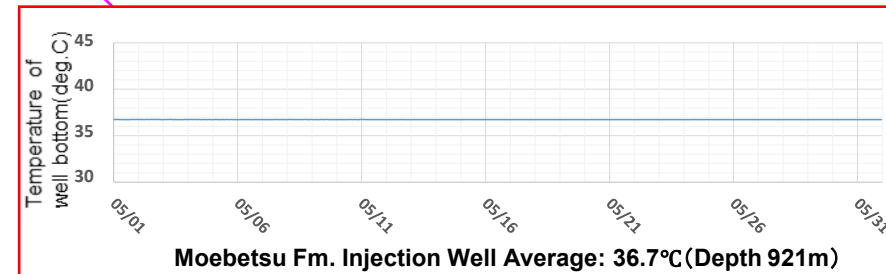
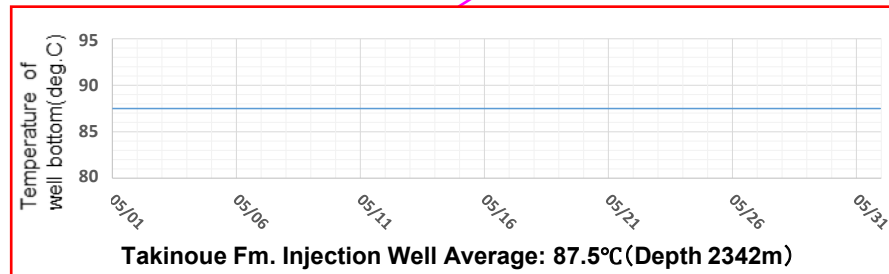
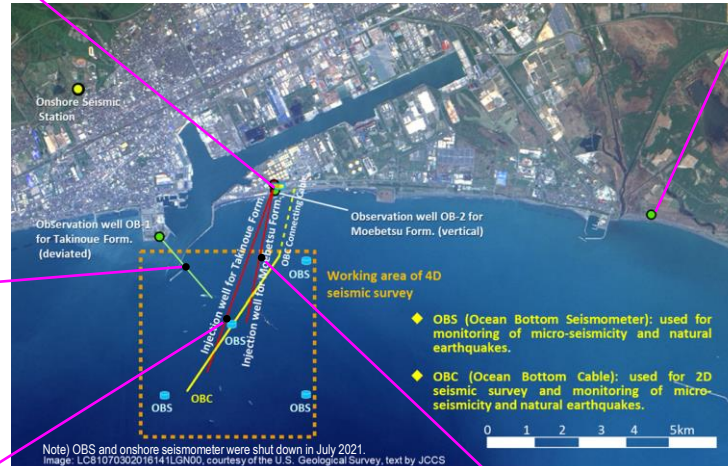
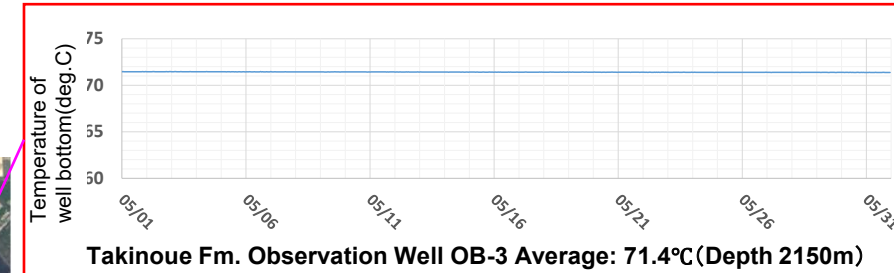
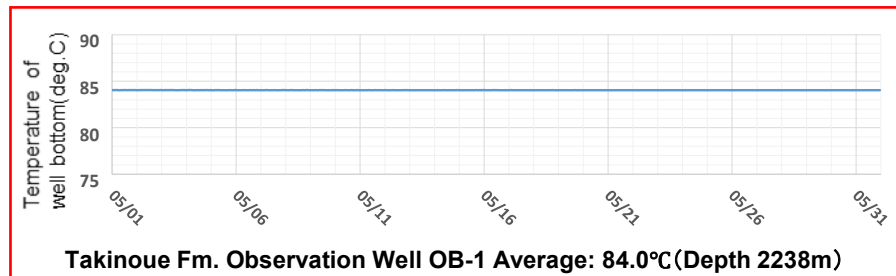
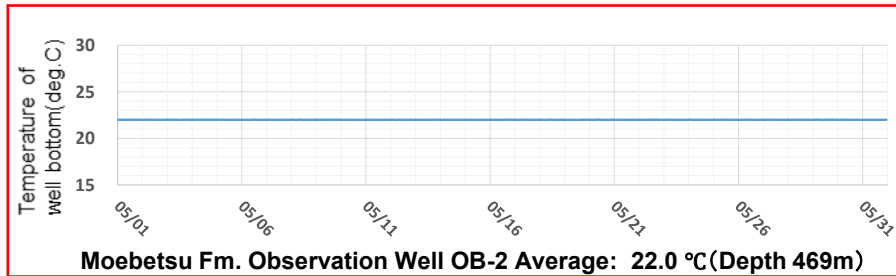
- There are perceptible earthquakes that can be felt, and imperceptible earthquakes that cannot be felt even though there are actual vibrations.
- In this project, particularly small (less than magnitude 1) imperceptible earthquakes are defined as micro-seismicity.
- In this project, micro-seismicity with a magnitude of -0.5 or more with a depth of less than 50 km in the vicinity of the injection point are monitored, due to restrictions on the placement of observation points, and constraints on seismograph detection capability, etc.

# Observation of pressure in the wells (May 2025)

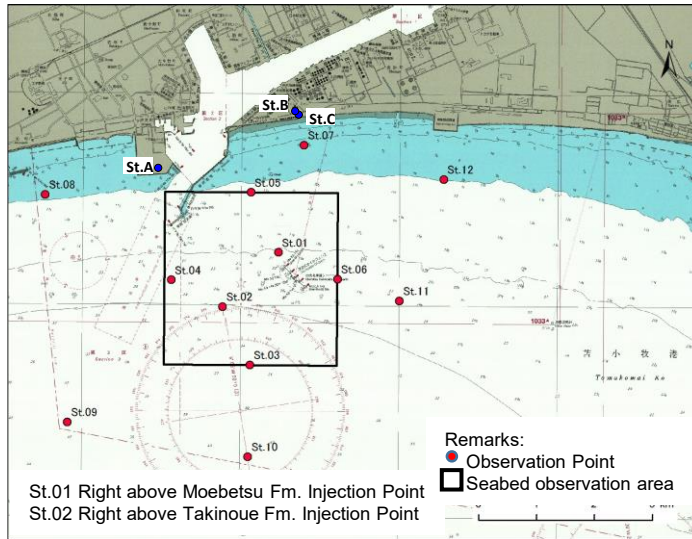




# Observation of temperature in the wells (May 2025)



# CO<sub>2</sub> Concentration around injection point(seasonal)



Cruise to the Japan Coast Guard issue navigation chart (W1034)

Seasonal observation of CO<sub>2</sub> concentration is conducted at three onshore points (St.A to C) and 12 offshore points (St.01 to 12). The concentration of CO<sub>2</sub> is indicated as Volume ratio (unit: volppm) at the onshore observation points, and as partial pressure (unit:  $\mu$  atm) at the offshore points. The figures of the offshore points are based on the measurement at 2 meters above the seabed.

