



Progress on Tomakomai CCS Demonstration Project

**CCS Technical Workshop 2014
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**Daiji Tanase
Japan CCS Co., Ltd. (JCCS)**

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1. Approach for CCS Demonstration Project

Company Profile and Project Framework of JCCS

Company Profile

Date of Incorporation: May 26, 2008

Business Description:

A comprehensive investigation for and implementation of CCS Demonstration Projects in Japan

Capital: 243 mm yen

Shareholders: 35 companies (As of July 1, 2013)

11 electric power, 5 engineering, 4 petroleum, 3 petroleum resource developing, 4 general trading, 2 iron and steel, 2 city gas, 1 chemical, 1 non-ferrous metal and cement, 1 steel pipe, 1 special trading

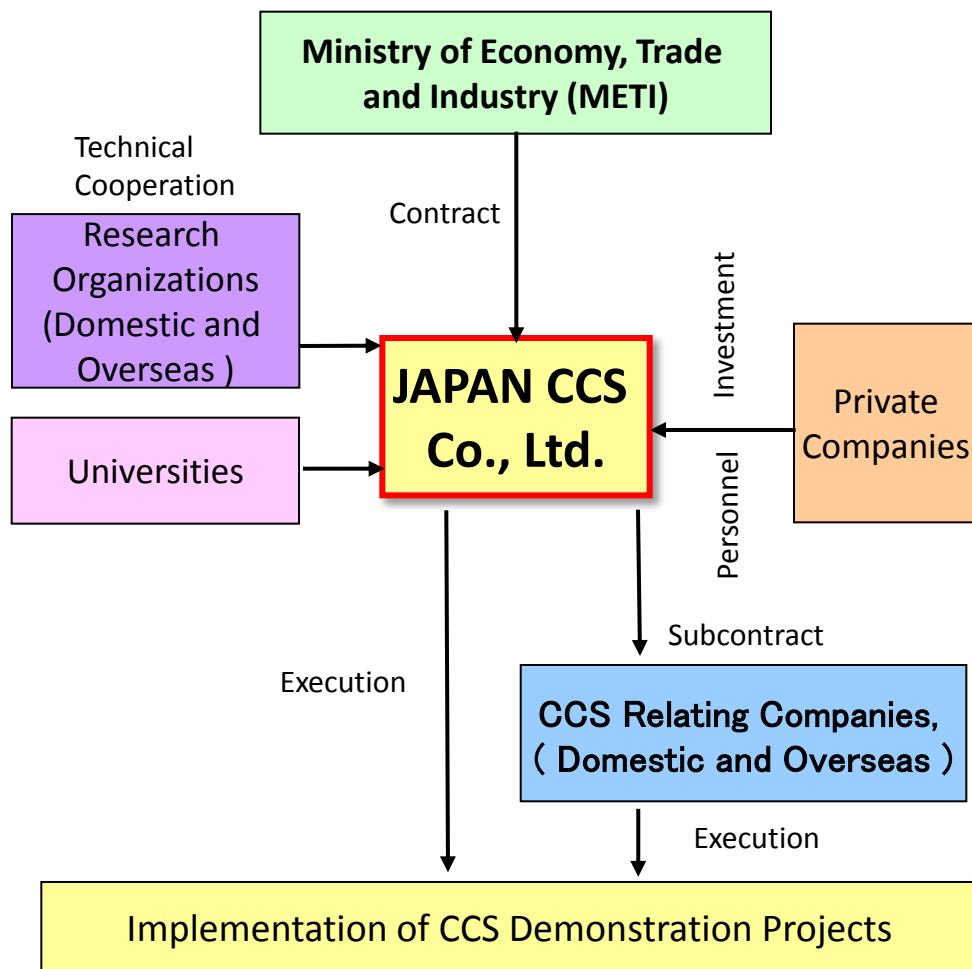
President: Shoichi Ishii, Senior MD for JAPEX

Directors: 6 representing the shareholders' industries

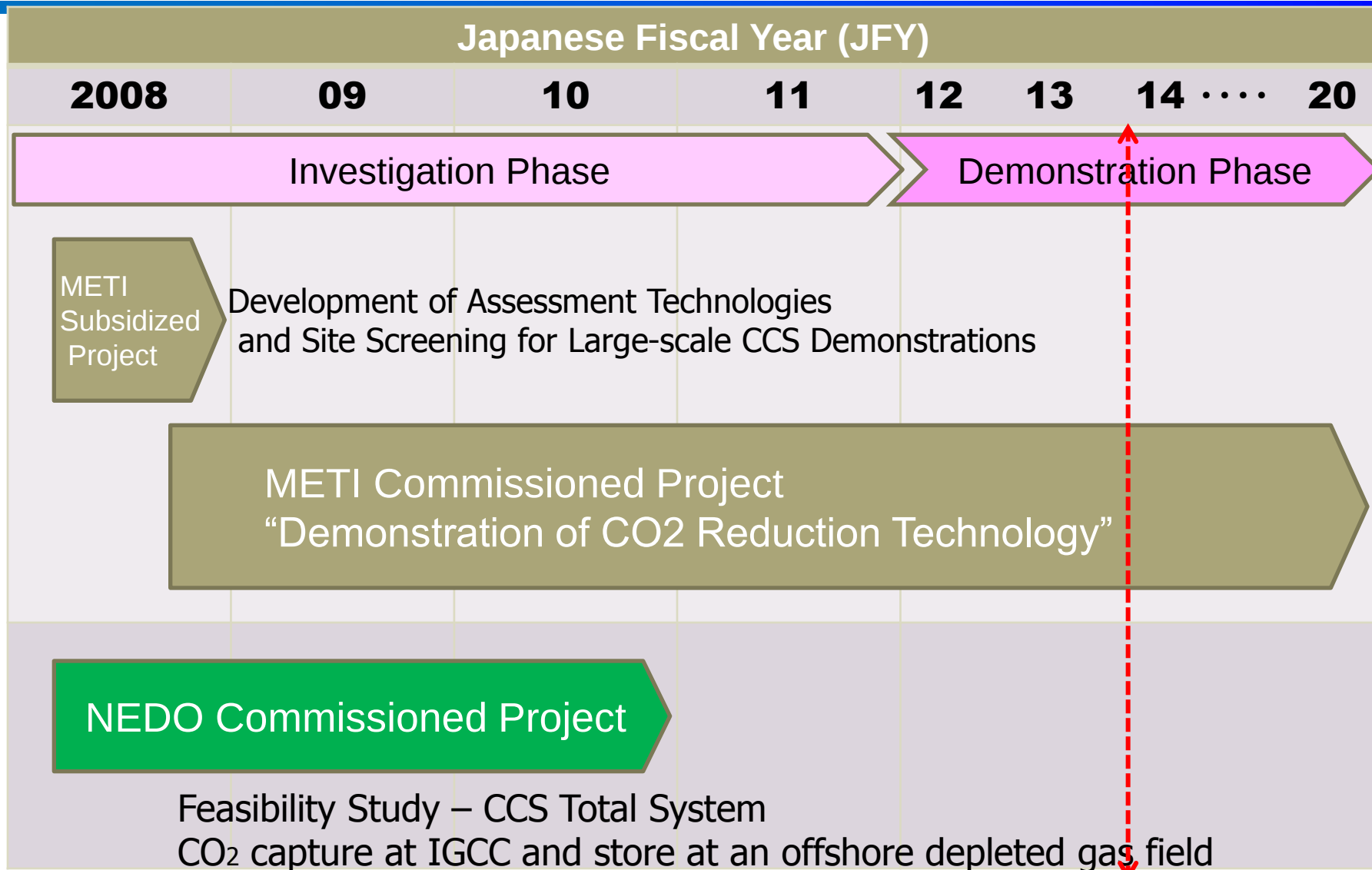
Auditor: Takashi Honjo, Senior MD for RITE

No. of Staff: 50

Project Frameworks -Functions of JCCS



CCS Demonstration Project Phase

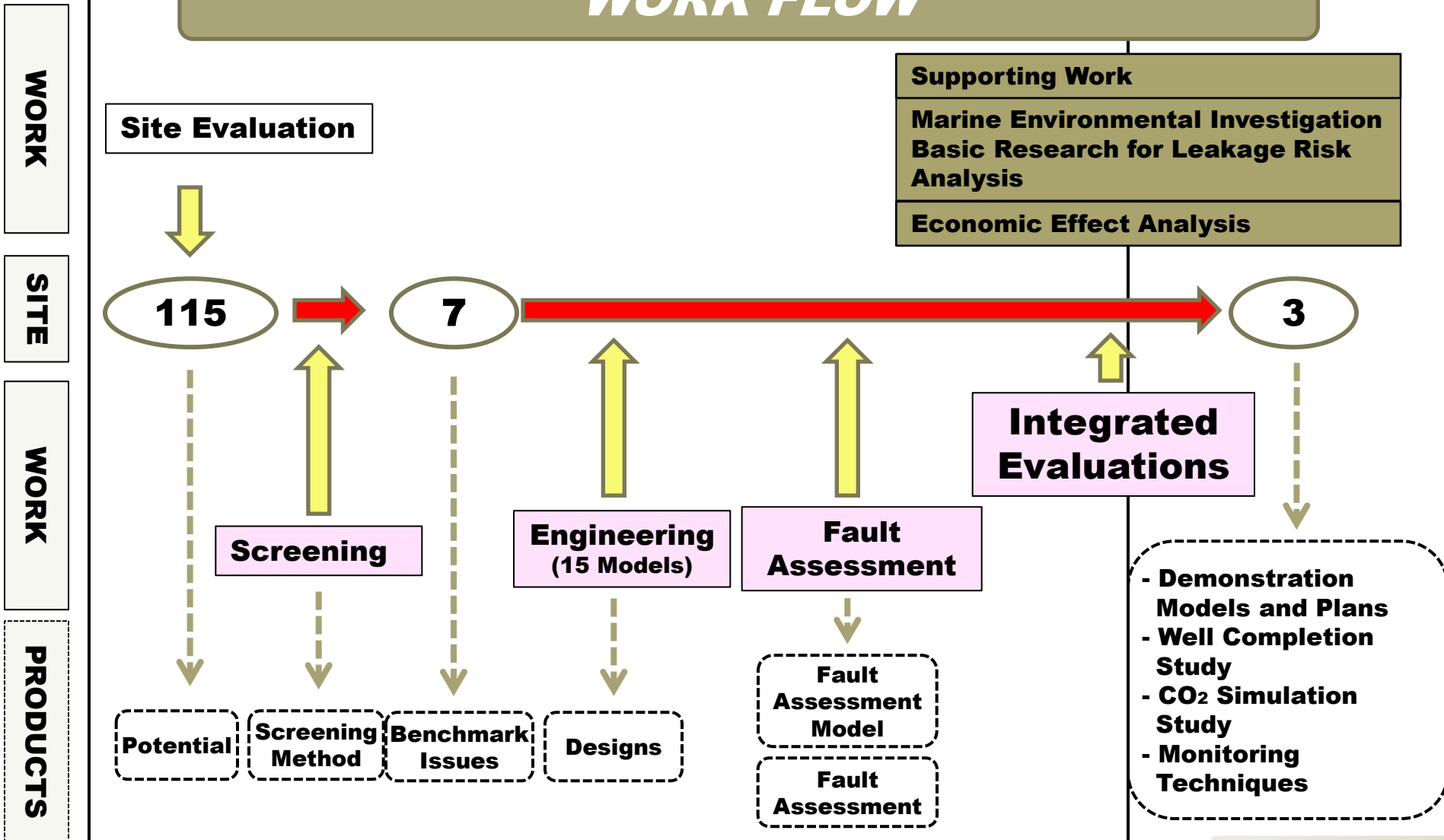


*Fiscal Year : April - March

Today

METI Subsidized Project in JFY 2008

WORK FLOW



Candidate Sites for CCS Demonstrations

Candidate Sites	Reservoir Types	CO ₂ Source	Trans- portation	Current status
Iwaki-oki	Depleted gas reservoir	IGCC	Offshore pipeline	1) Geological modeling and simulation *
Tomakomai	Saline aquifer with closure	Refinery	Onshore pipeline and lorries	1) Seismic survey 2) Survey well 3) Geological modeling and simulation
	Saline aquifer without closure (Neogene)			
Kitakyushu	Saline aquifer without closure (Palaeogene)	Preliminary survey well		

*1: Additional investigations were discontinued because of the Great East Japan Earthquake.

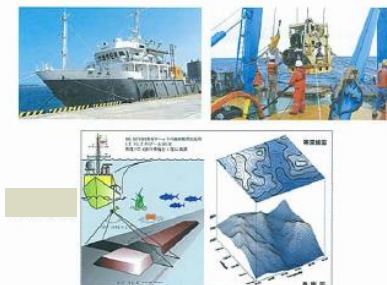
Tomakomai



Kitakyushu



Nakoso-Iwaki Oki

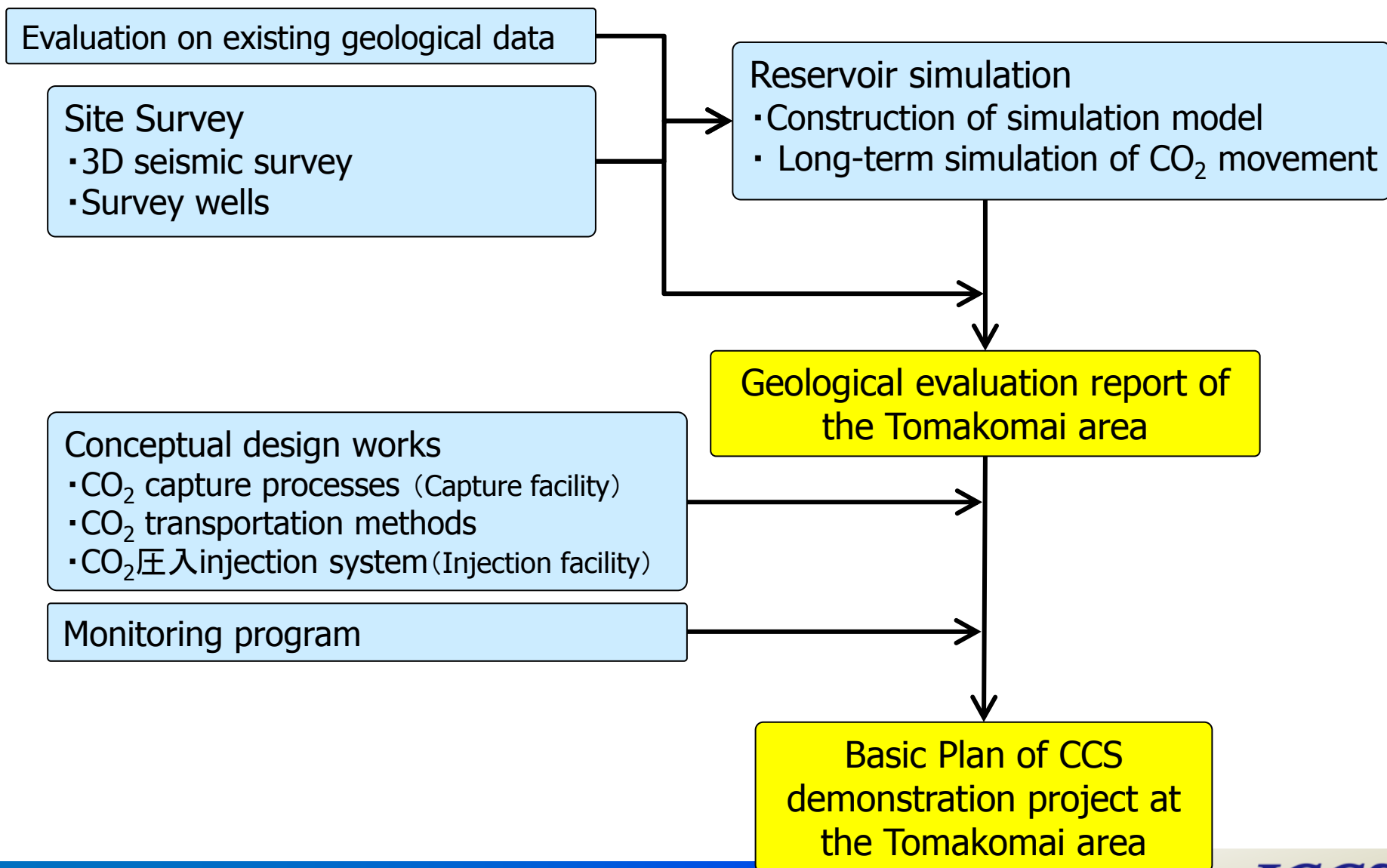


2. Investigation Works at Tomakomai Site

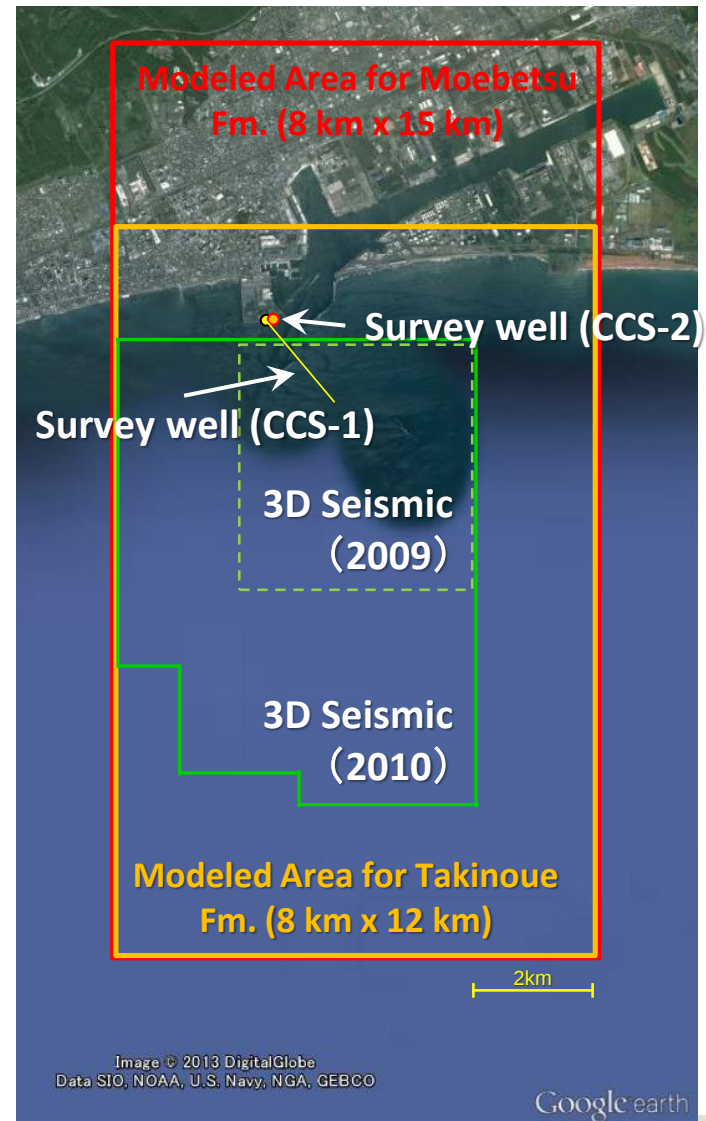
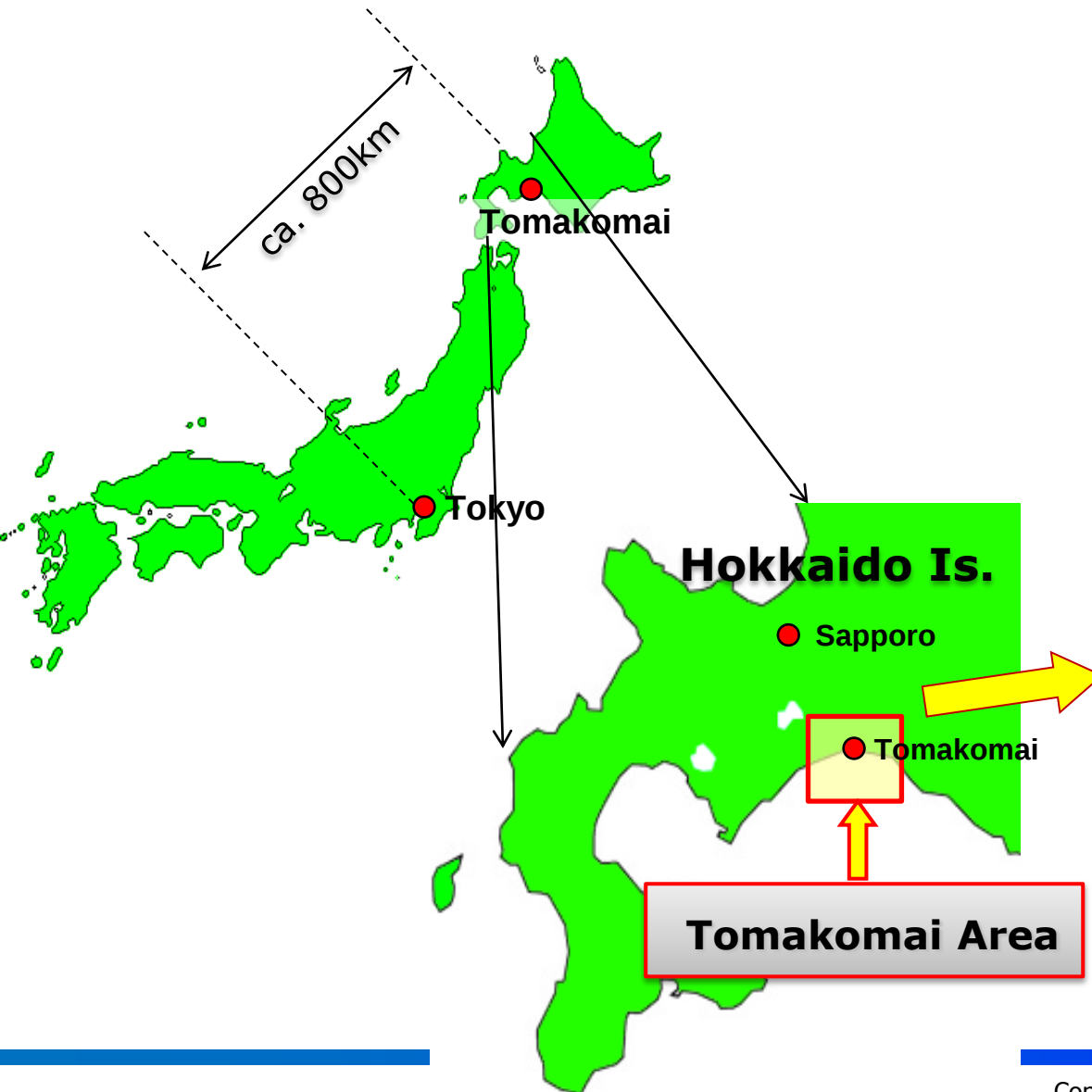
Outcome from the Investigation Phase of TomakomaiSite

JFY.2009~2011

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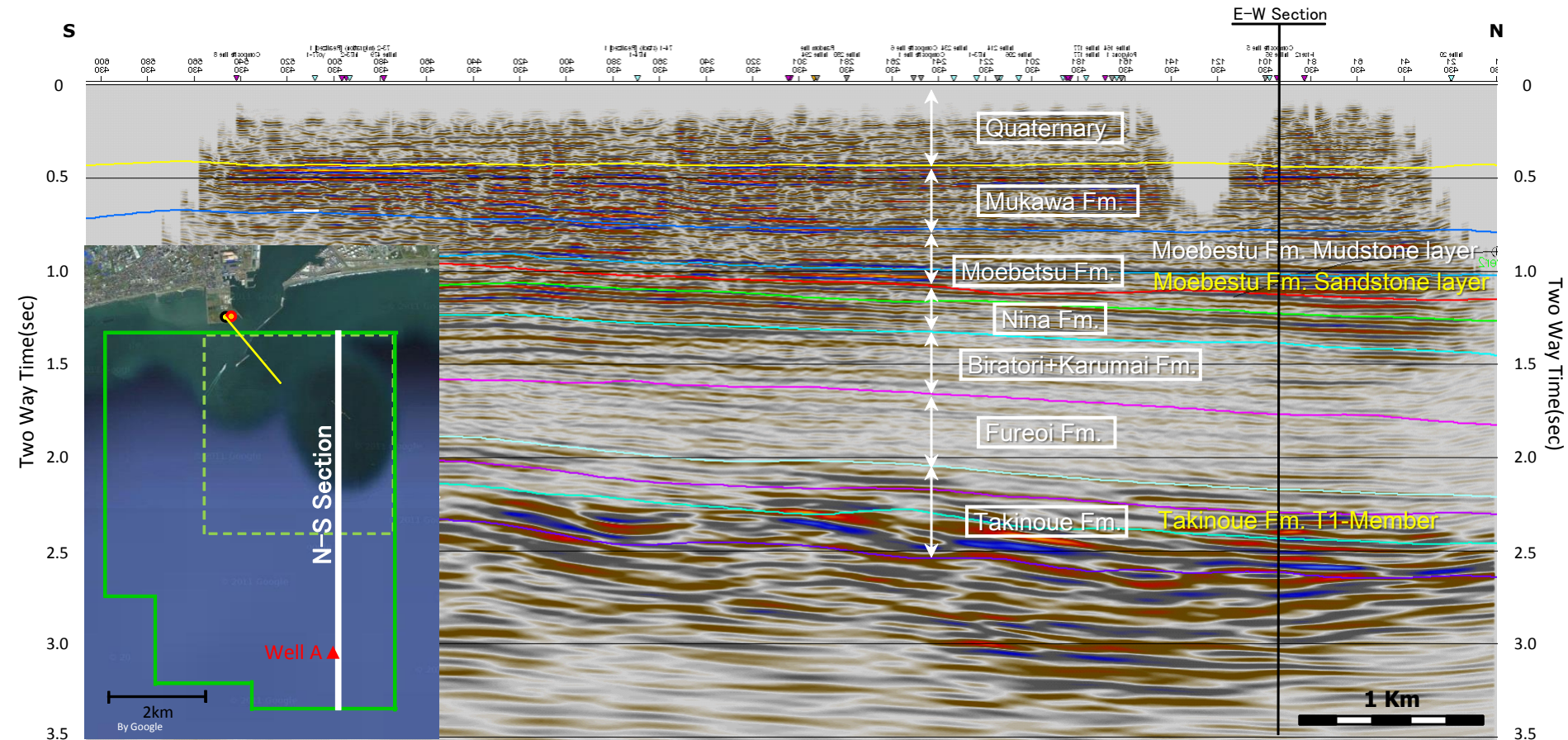


Investigation Works at Tomakomai Site : JFY.2009~2011



Geological Structure of the Tomakomai Site

◆ North-South Section by 3D Seismic Survey



From a document of “The evaluation Committee for CCS Demonstration Project of METI (2011)”

Survey Wells: Tomakomai CCS-1 & CCS-2

Tomakomai CCS-1



Rig: 48.5m high

- For Takinoue Fm.
- Term: Nov. 2010 – Mar. 2011
- Deviated well
- Drill depth : 3,700m
- Vertical depth : 3,047m
- Horizontal reach : 1,757m
- Max. inclination : 42°

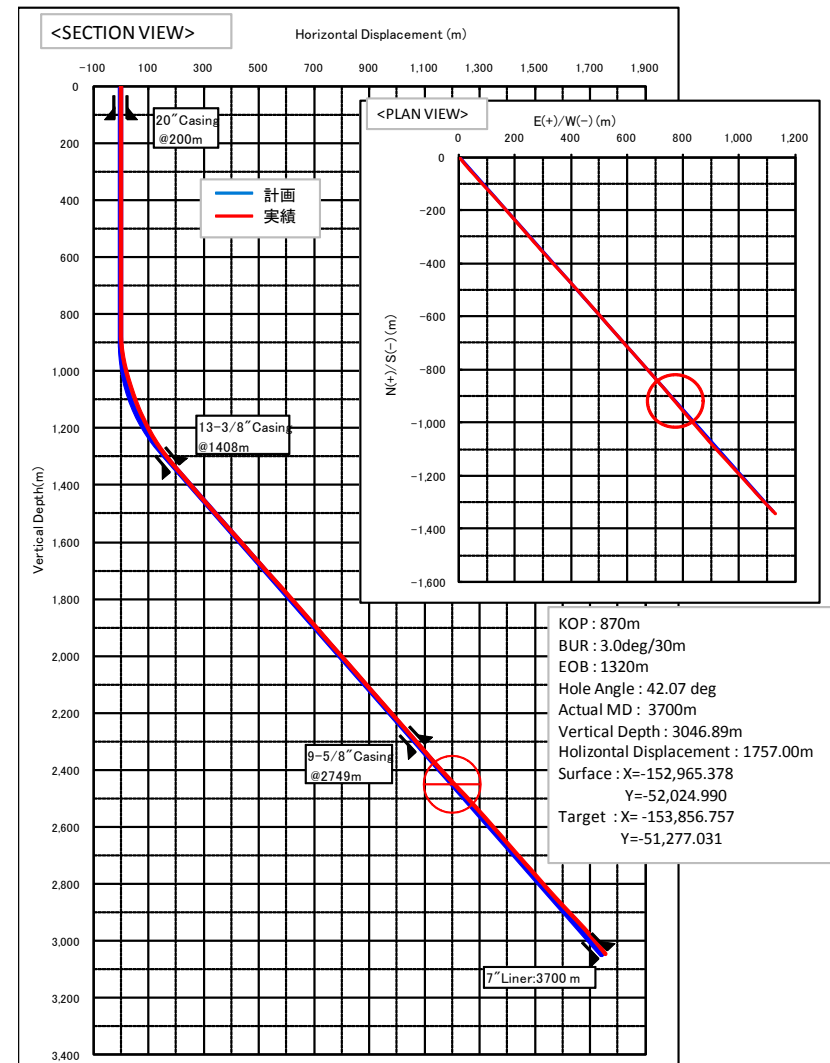
Tomakomai CCS-2



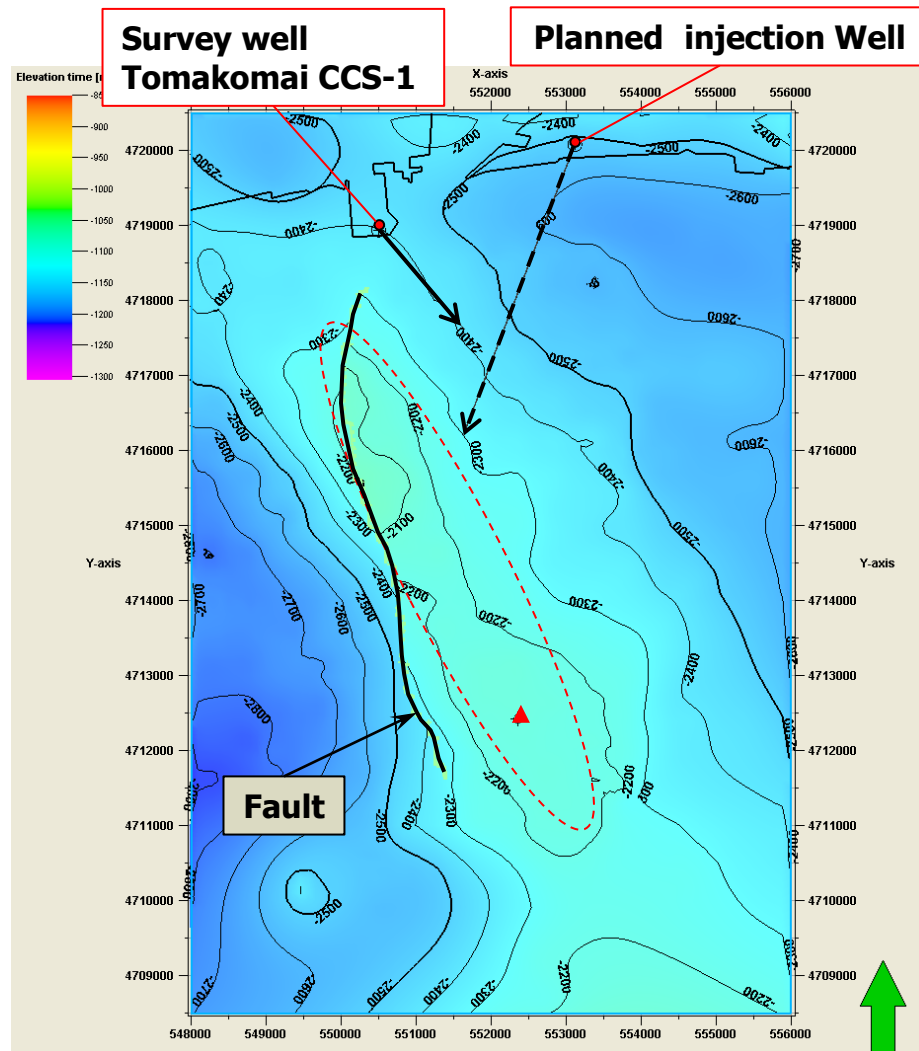
Rig: 30.2m high

- For Moebetsu Fm.
- Term: Apr. 2011 – Jul. 2011
- Vertical well
- Drilled depth : 1,218m

Section view of Tomakomai CCS-1



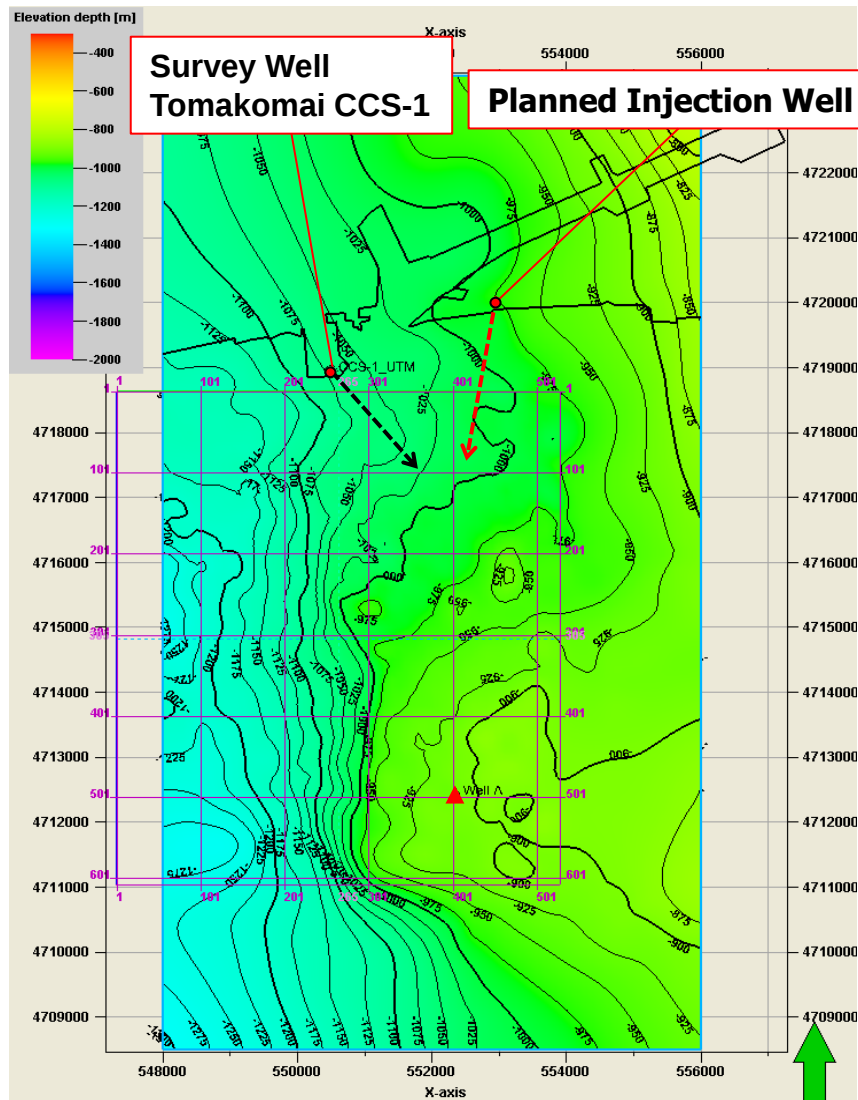
Geological Evaluation on Takinoue Formation



◆ Depth structure map for the top of the Takinoue Formation

- The reservoir is the T1 Member of the Takinoue Formation of 2,400 to 3,000 m deep below the seabed.
- Miocene saline aquifer composed of volcanic and volcanoclastic rocks of about 600m thick.
- Porosity and permeability of 3 to 19% and 0.01md to 2.6D, respectively.
- Covered by about 1,100m thick Miocene mudstone layers (Fureoi Formation, Biratori-Karumai Formation and Nina Formation) as cap rocks.
- Anticlinal structure with a NNW-SSE trending axis in a wider range.
- Planned injection point penetrates the north-eastern wing of the anticline with a NE dip of about 15 degrees.

Geological Evaluation on Moebetsu Formation

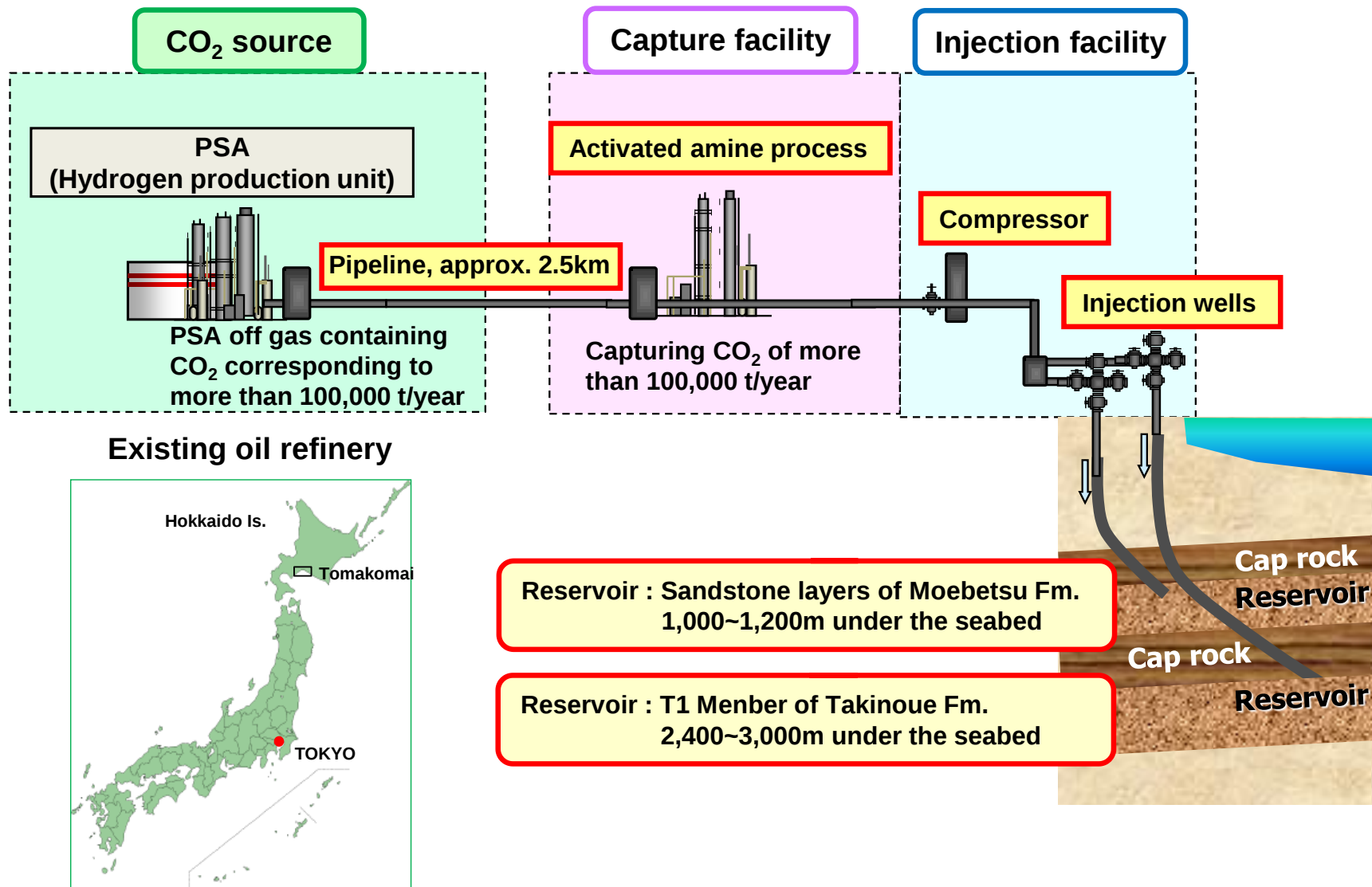


◆ Depth structure map for the top of the reservoir

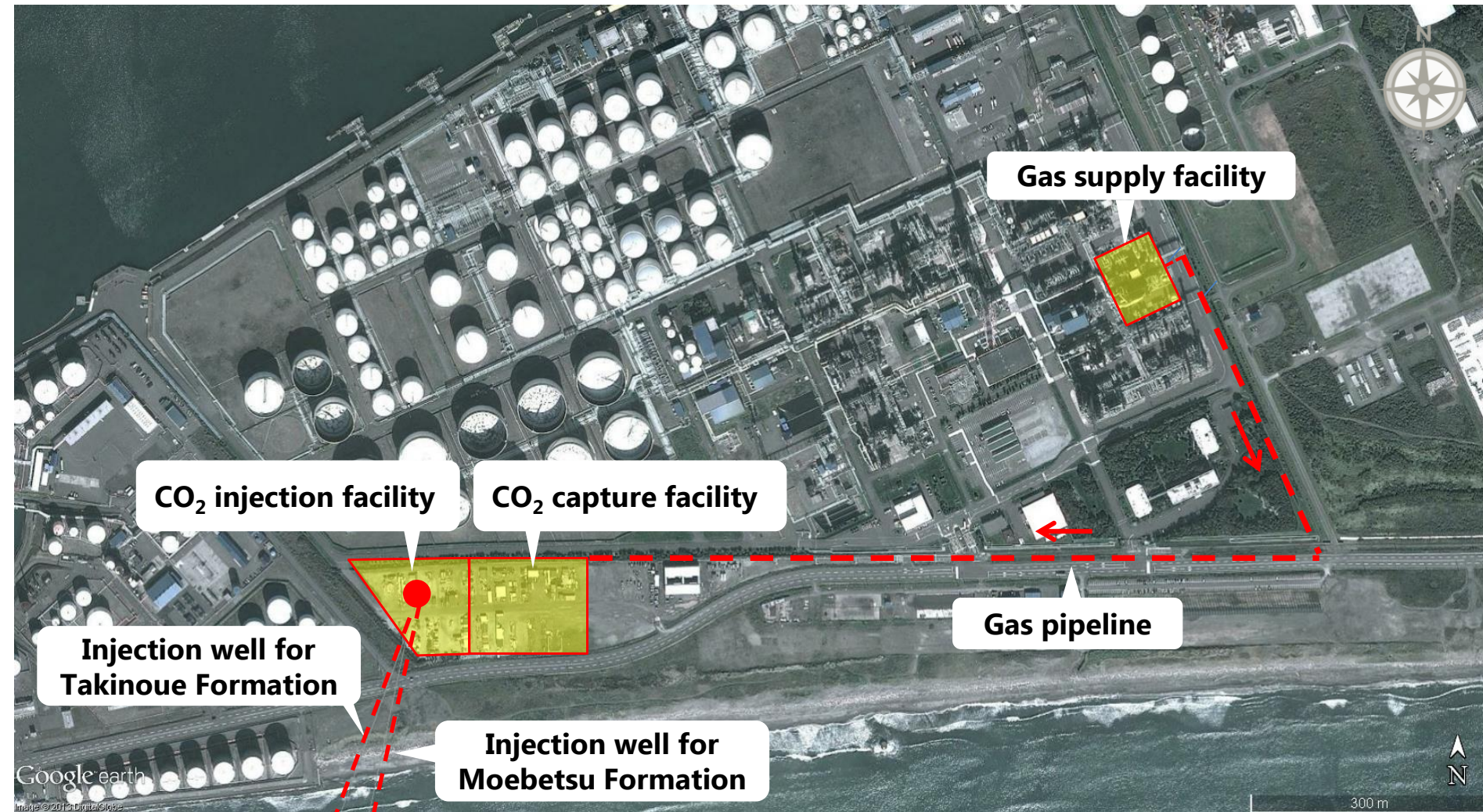
- The reservoir, a sandstone layer of Lower Quarternary Moebetsu Formation is distributed 1,100 to 1,200 m deep below the seabed.
- Porosity and permeability of the reservoir are 20 to 40% and 9 to 25md, respectively.
- The reservoir is covered by an about 200m thick mudstone layer of the Moebetsu Formation as a cap rock.
- The reservoir has gentle monocline structure with a NW dip of 1 to 3 degrees at the planned injection point.

3. Plan of Tomakomai CCS Demonstration Project

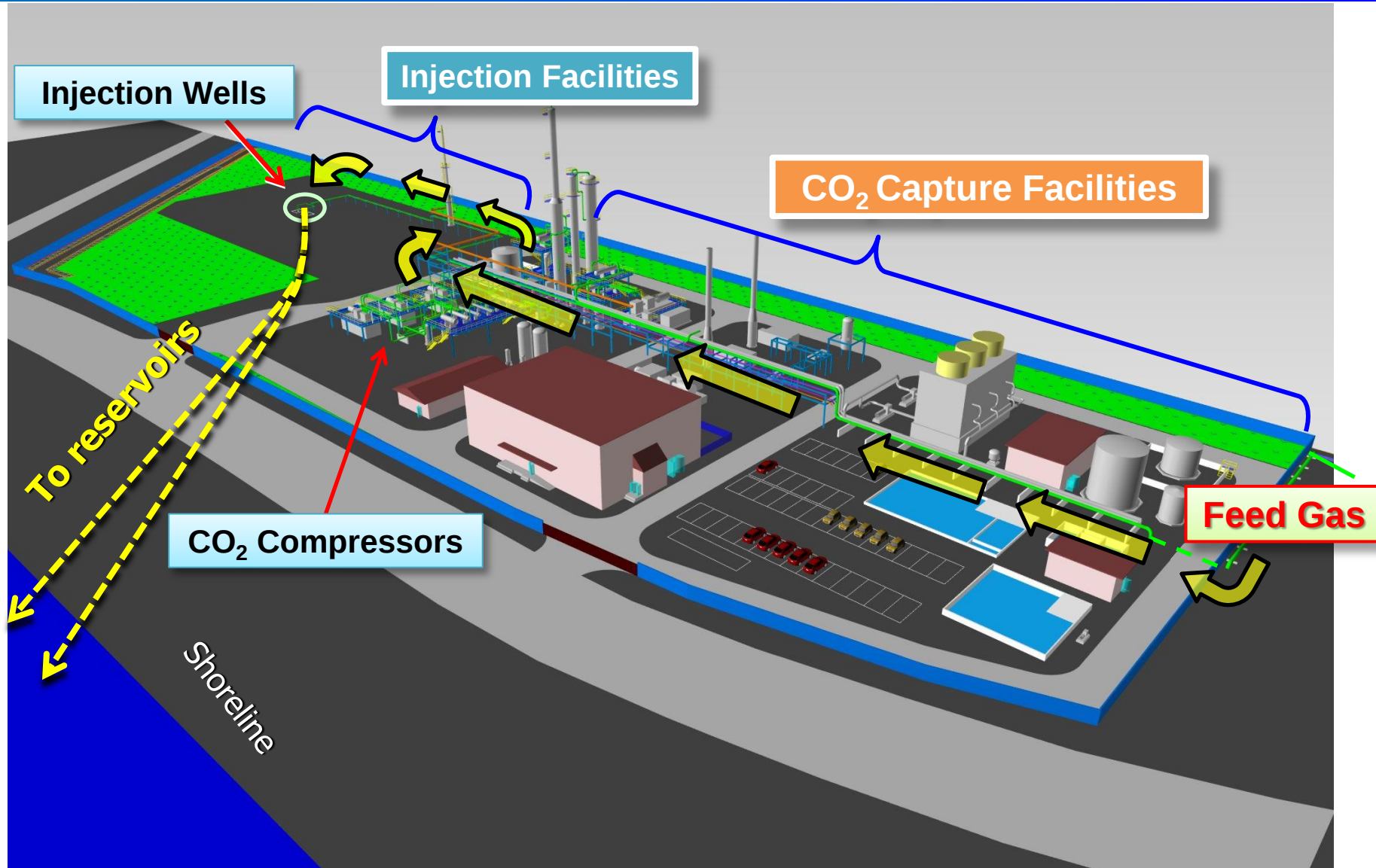
Flow Scheme of CCS Demonstration Project



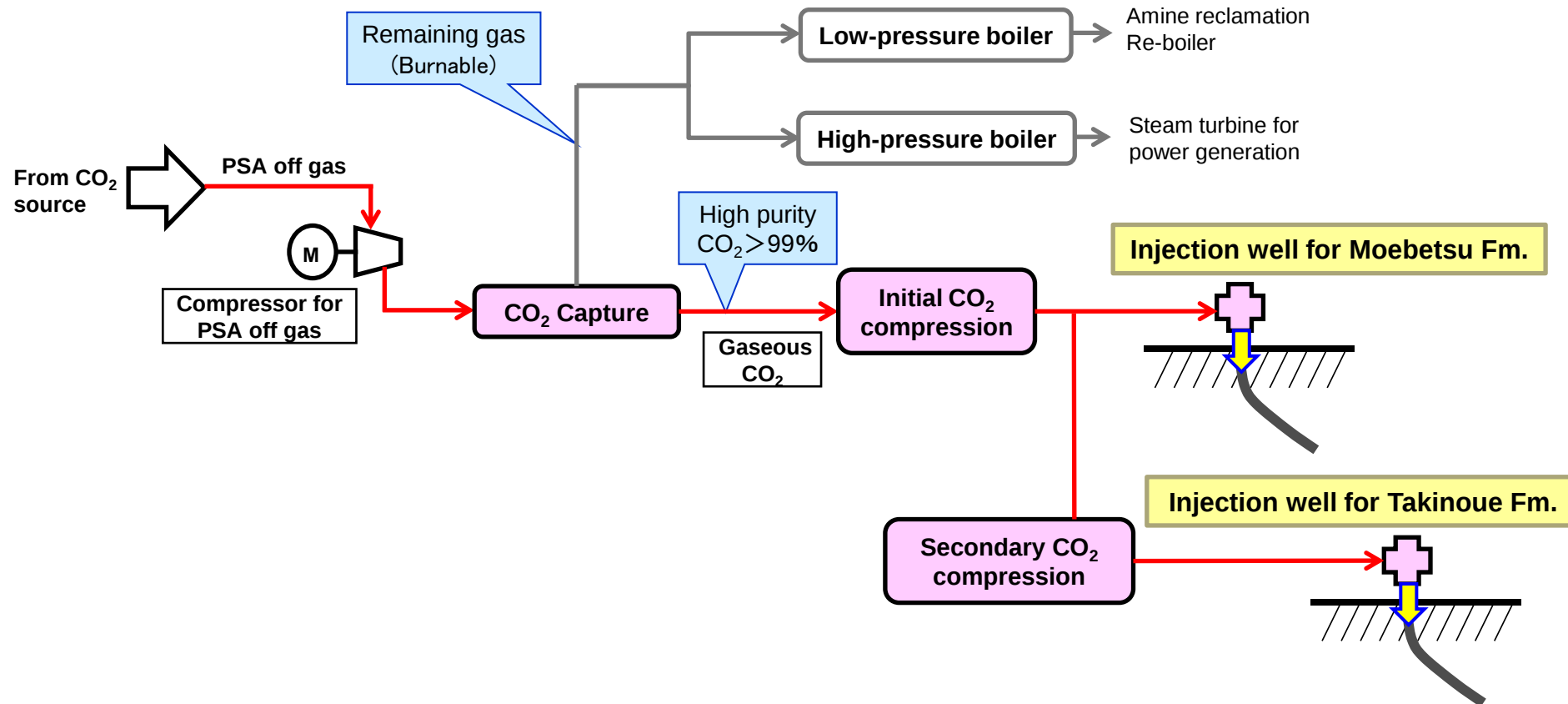
Positional Relation of Onshore Facilities



Bird's Eye View of the Onshore Facilities



CO₂ flow from Capture to Injection

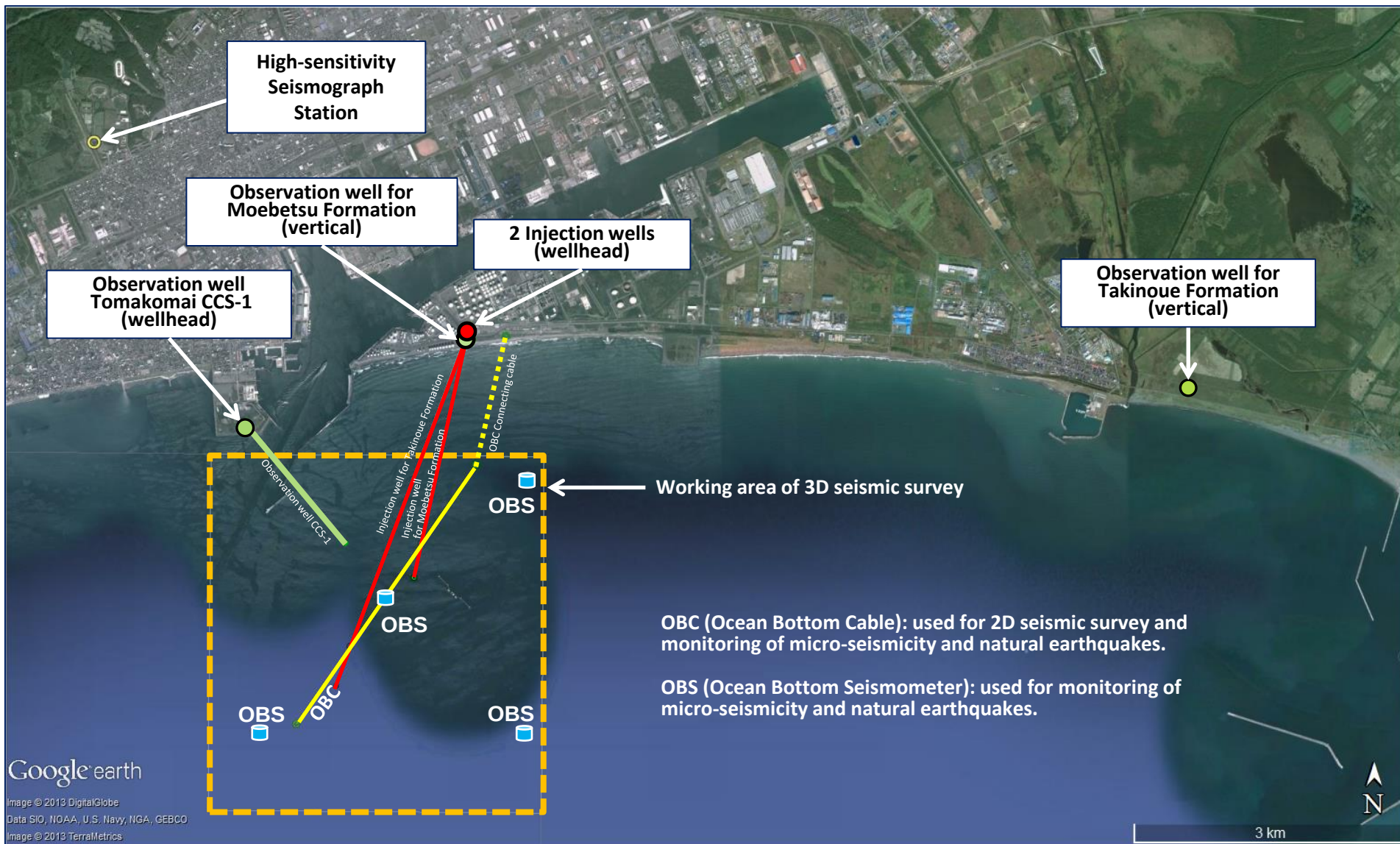


Planned Monitoring Items

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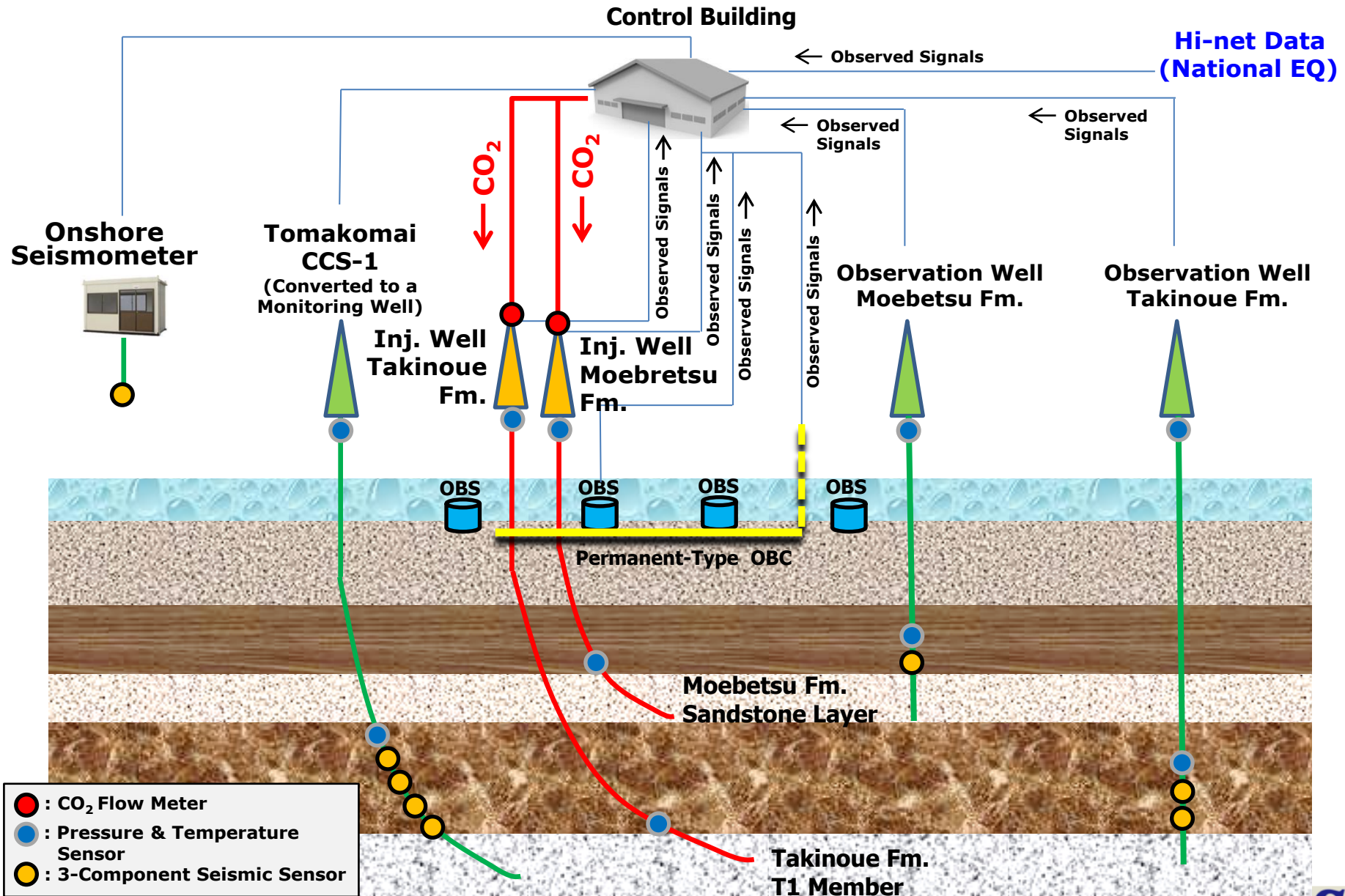
Items	Observed objects	Observation frequency	Remarks
Injection well	◆ Downhole : Temperature and Pressure ◆ Wellhead : Pressure, Injection rate of CO₂	Continuous	◆ One injection well for Takinoue Formation ◆ One injection well for Moebetsu Formation
Observation well	◆ Downhole : Temperature and Pressure, micro-seismicity and natural earthquakes	Continuous	◆ One observation well converted from an survey well ◆ One observation well for Takinoue Formation ◆ One observation well for Moebetsu Formation
OBC : Ocean Bottom Cable	◆ Micro-seismicity and natural earthquakes ◆ Signal of 2D seismic survey	Continuous	OBC line passes directly above the injection points of reservoirs.
OBS : Ocean Bottom seismometer	◆ Micro-seismicity and natural earthquakes	Continuous	◆ Above the injection point of Takinoue Formation : One unit ◆ Surrounding area of injection points of two reservoirs : 3 units
Onshore seismometer	◆ Micro-seismicity and natural earthquakes	Continuous	◆ West region of Tamakomai city
2D seismic survey	◆ Distribution of CO₂	Periodic	◆ Utilizing OBC as seismic sensors
3D seismic survey	◆ Distribution of CO₂	Periodic	A Baseline survey was completed during the investigation period.
Marine environmental monitoring	◆ Chemical, physical and biological data	Periodic	Monitoring plan is to be drawn up after the baseline survey and marine environmental impact assessment.

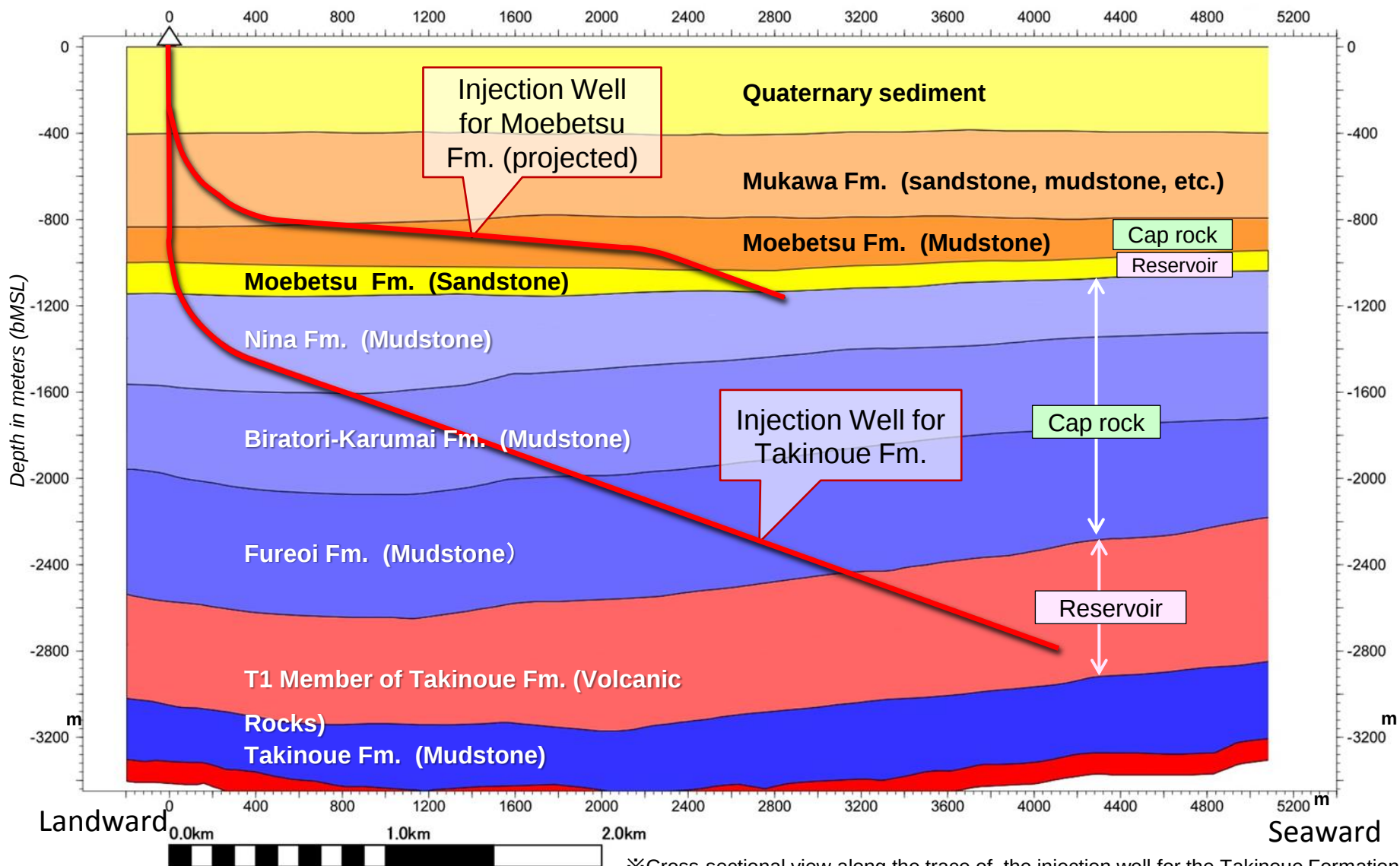
Positional Relation of Injection & Monitoring Systems



Conceptual Diagram of Monitoring System

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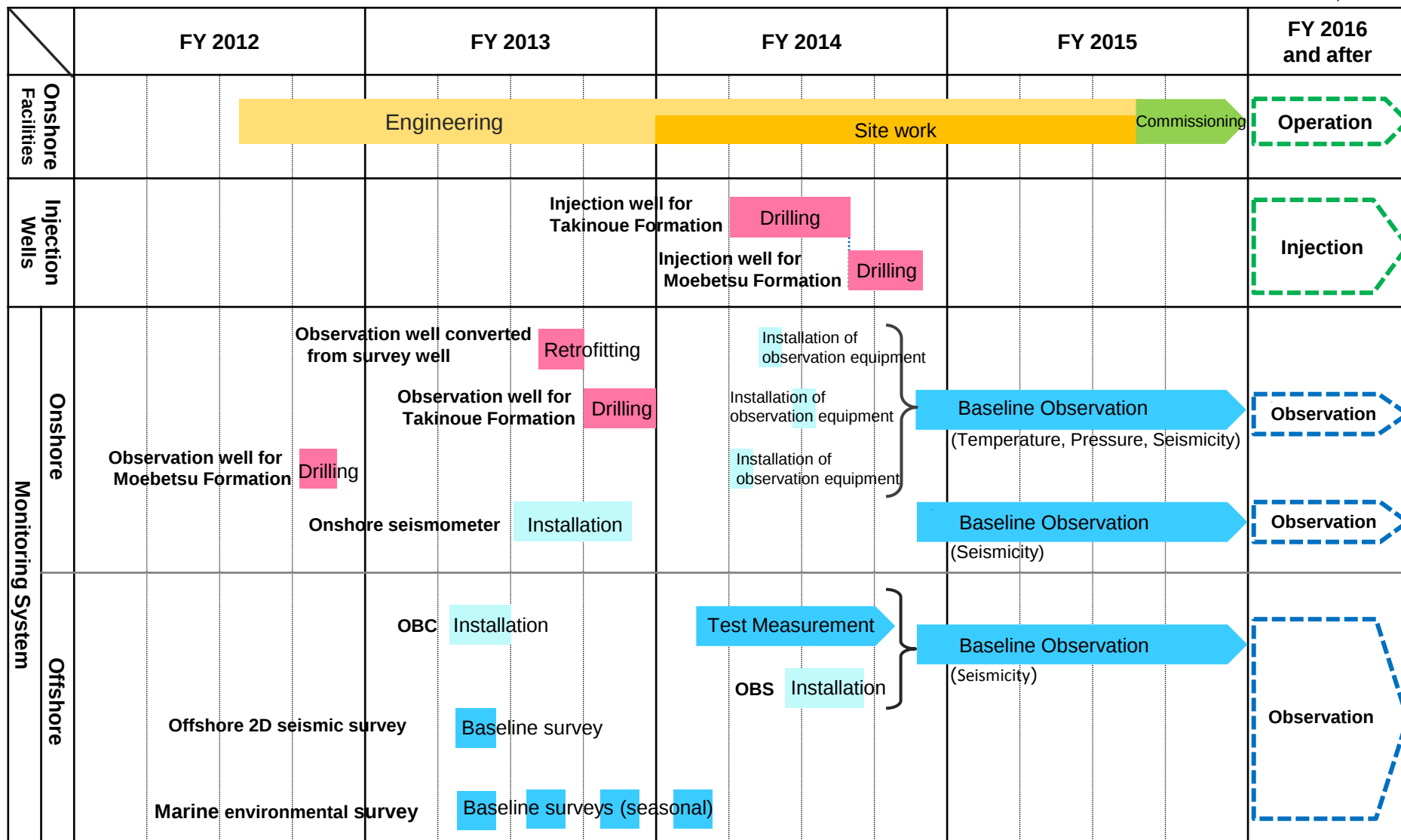




4. Progress on Tomakomai CCS Demonstration Project from JFY.2012

Schedule in EPC Period of the Tomakomai CCS Project 25

As of Oct. 23, 2013



OBC (Ocean Bottom Cable) : used for 2D seismic survey and monitoring of micro-seismicity and natural earthquakes.

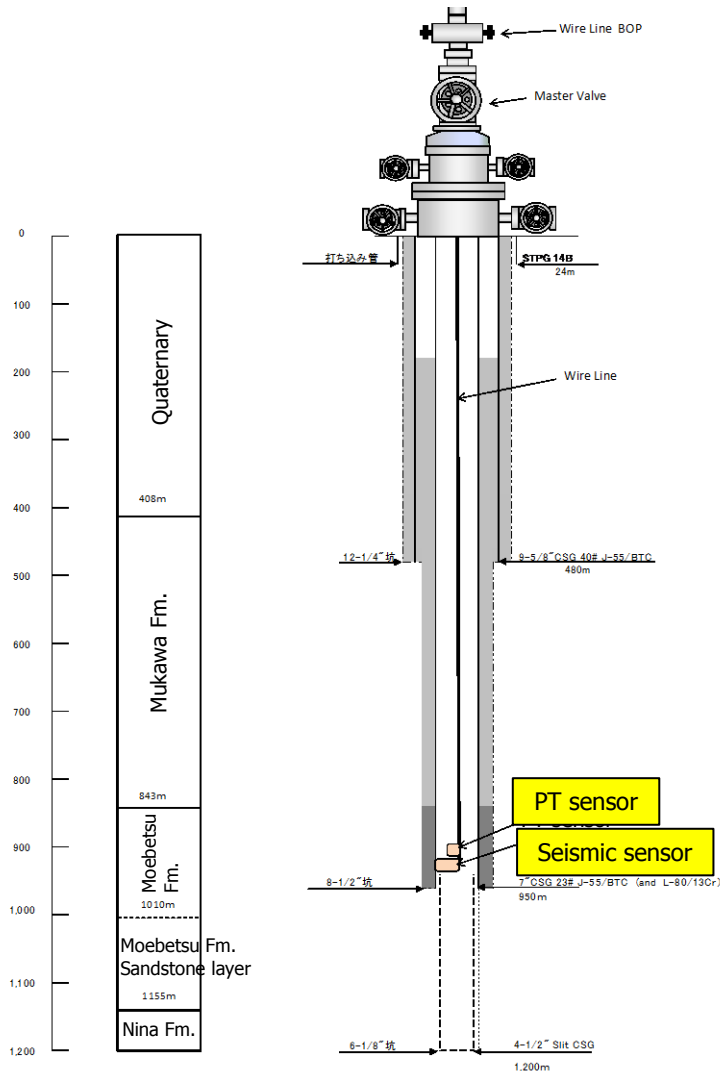
OBS (Ocean Bottom Seismometer) : used for monitoring of micro-seismicity and natural earthquakes.

Works from FY. 2012 to FY. 2013

- Drilling of observation well for Moebetsu Fm. : Dec. 2012 - Mar. 2013
- EPC works of the capture and injection facilities : started Nov. 2012
- Detailed design of the capture facility : started Jun. 2013
- Installation of permanent-type ocean bottom cable (OBC) : Jul. 2013 - Aug. 2013
- Baseline 2D seismic survey : Aug. 2013
- Marine environmental survey (summertime baseline) : Aug. 2013
- Installation of onshore seismometer : Sep. 2013 – Mar. 2014
- Baseline marine environmental survey (fall-time baseline) : Nov. 2013
- Refurbishment work of Tomakomai CCS-1 to observation well : Nov. 2013 - Jan. 2014
- Drilling of Observation well for Takikoué Fm. : Jan. 2014 - Apr. 2014
- Marine environmental survey (wintertime baseline) : Feb. 2014

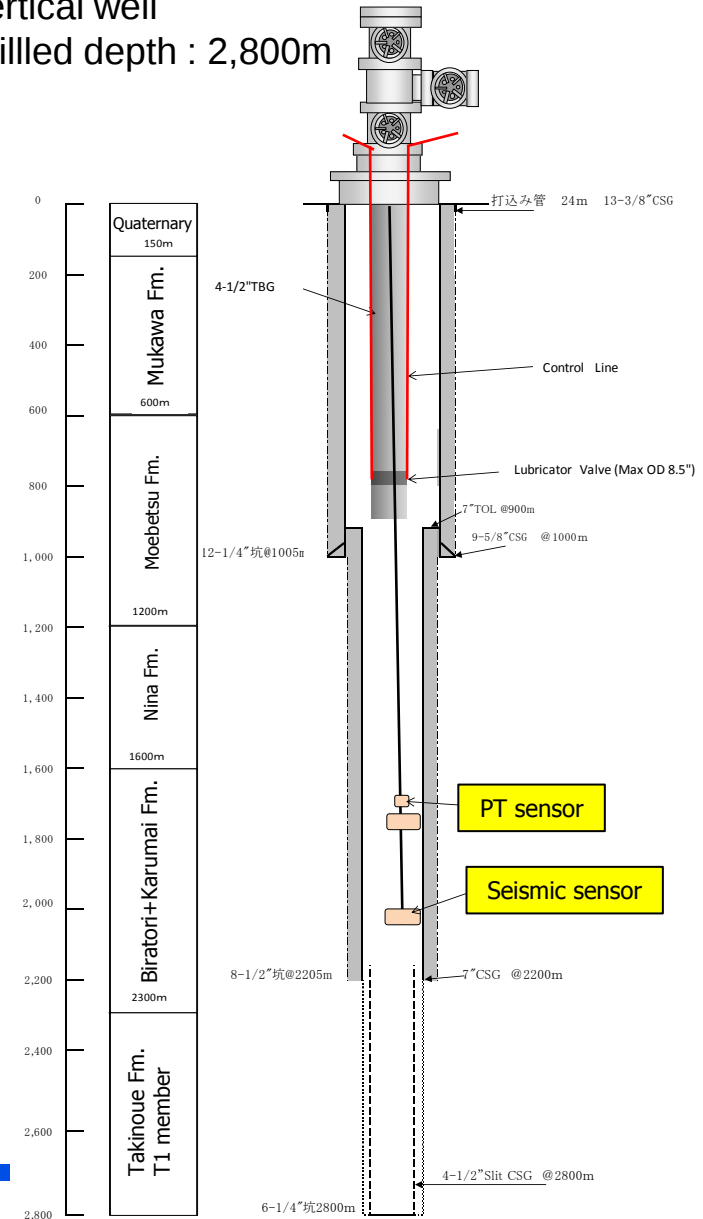
Observation well for Moebetsu Fm.

- Vertical well
- Drilled depth : 1,200m

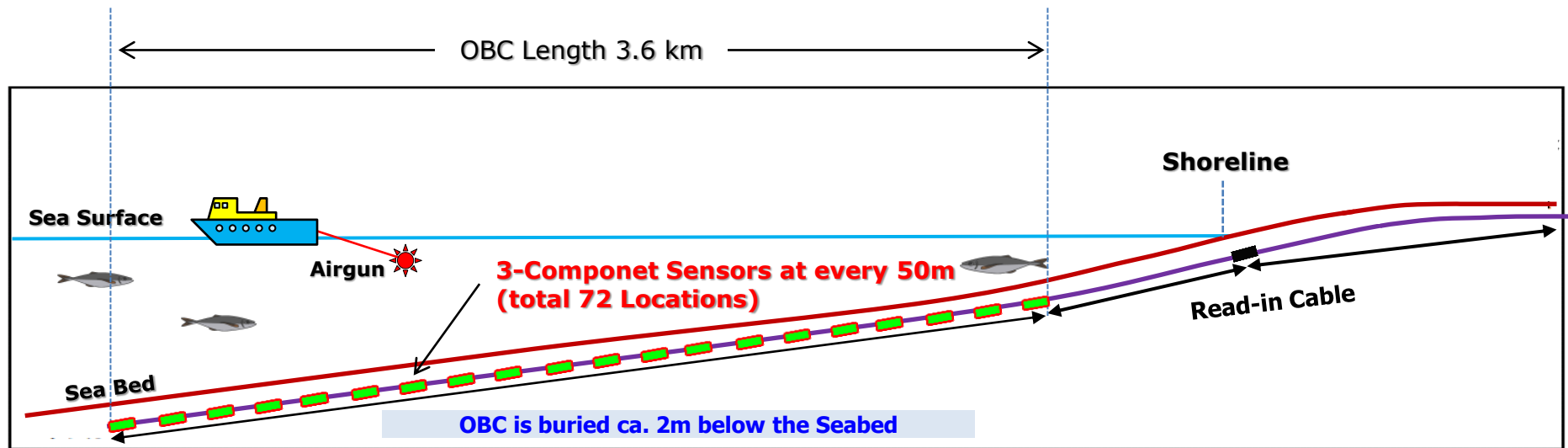


Observation well for Takinoue Fm.

- Vertical well
- Drilled depth : 2,800m



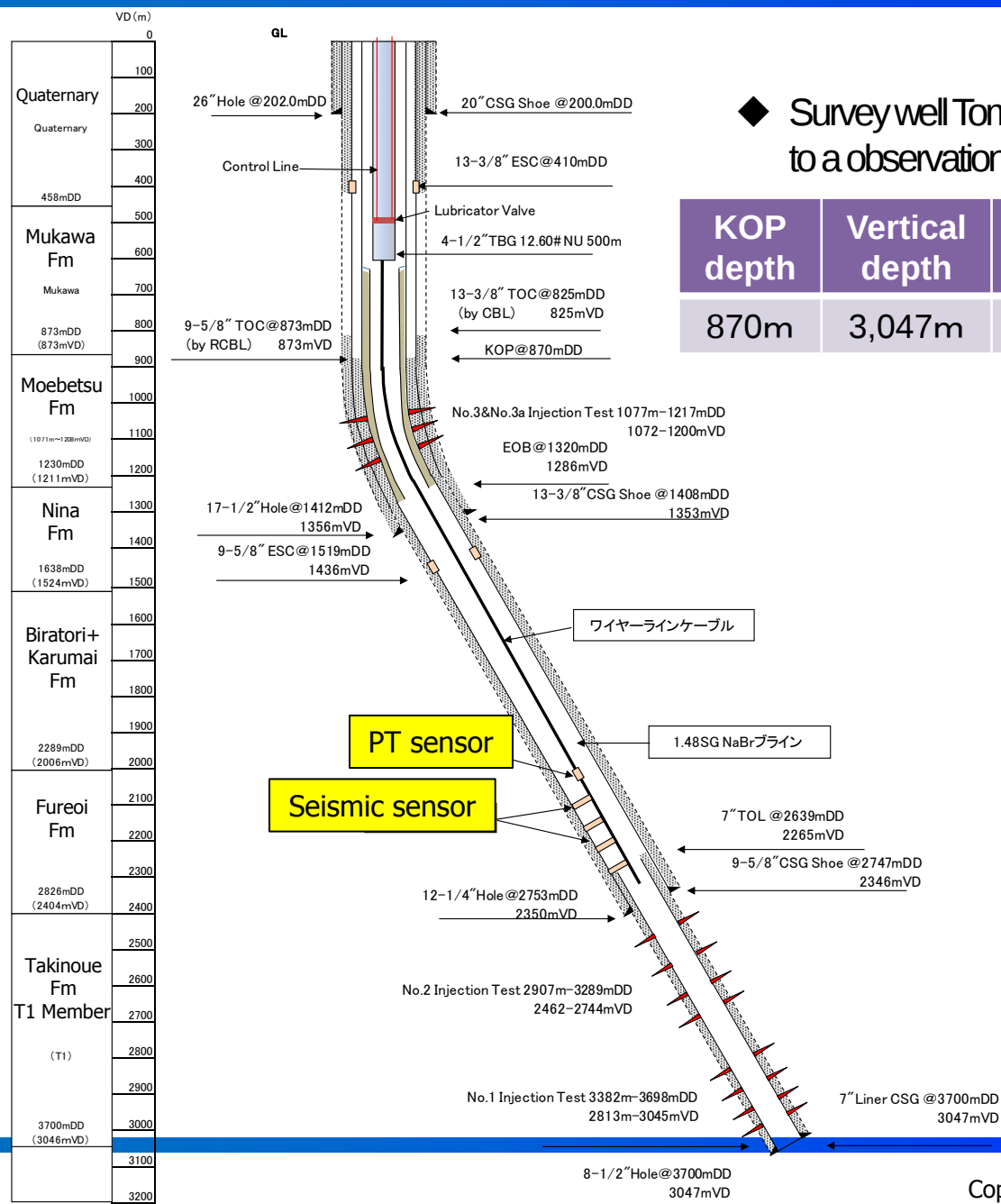
Schematic Diagram of Permanent-type OBC



Salvage barge for cable burial



Burying machine



◆ Survey well Tomakomai CCS-1 is to be refurbished to a observation well.

KOP depth	Vertical depth	Horizontal reach	Maximum inclination	Drill depth
870m	3,047m	1,757m	42°	3,700m

Marine environment shall be surveyed based on “**Act on Prevention of Marine Pollution and Maritime Disaster**” by which geological storage of CO₂ under the seabed is regulated.

1. Planned Survey Area (Fig)

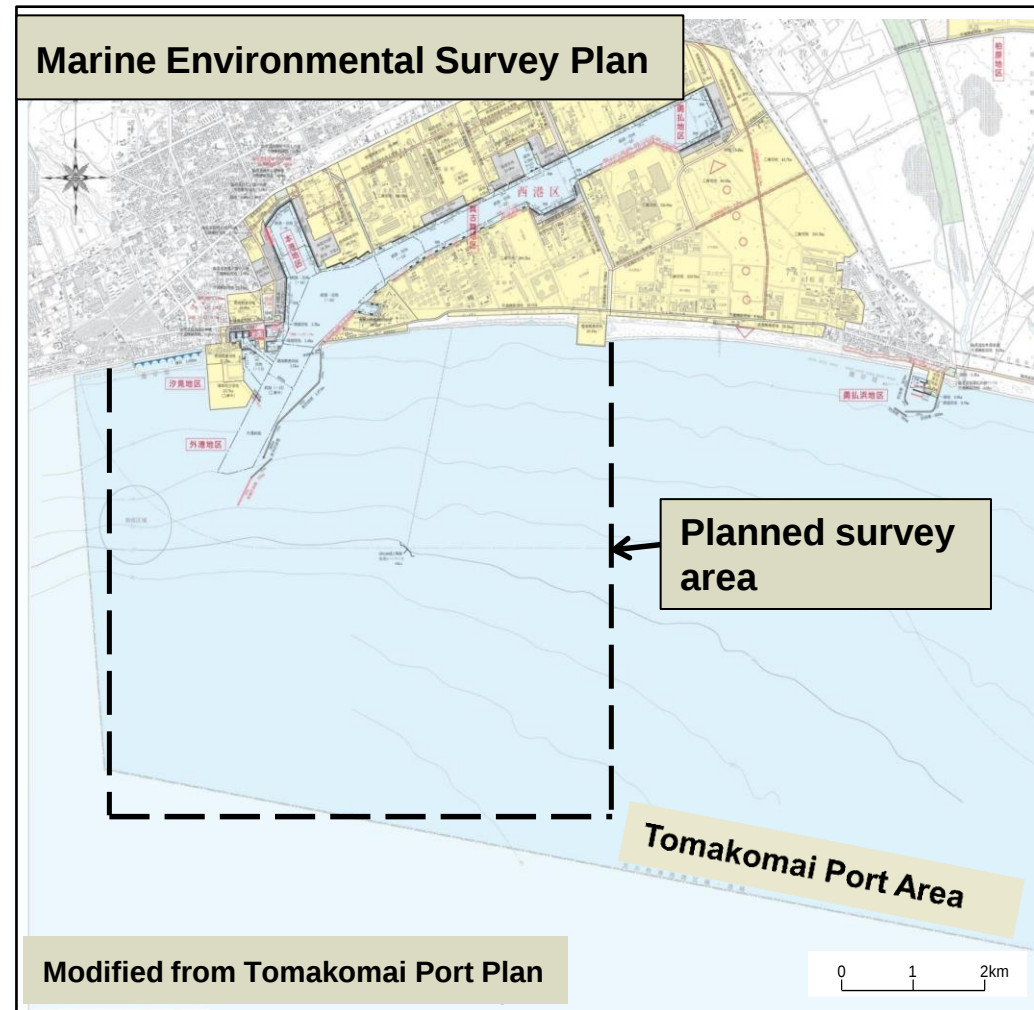
- At 12 survey points in the Tomakomai port area

2. Methods of Survey

- Seabed survey by Side-Scan Sonar and Sub-bottom Profiler
- Current direction and speed survey by Current Meter
- Sampling of seawater by Water Sampler for concentration of salt etc. and plankton observation
- Seabed mud survey by Bottom Sampler
- Collection of benthos by Net or Dredge Unit
- Observation of benthos by divers or ROV

3. Surveys in three stages

- During EPC period
- During demonstration operation
 - During CO₂ injection
 - After CO₂ injection
- After demonstration operation

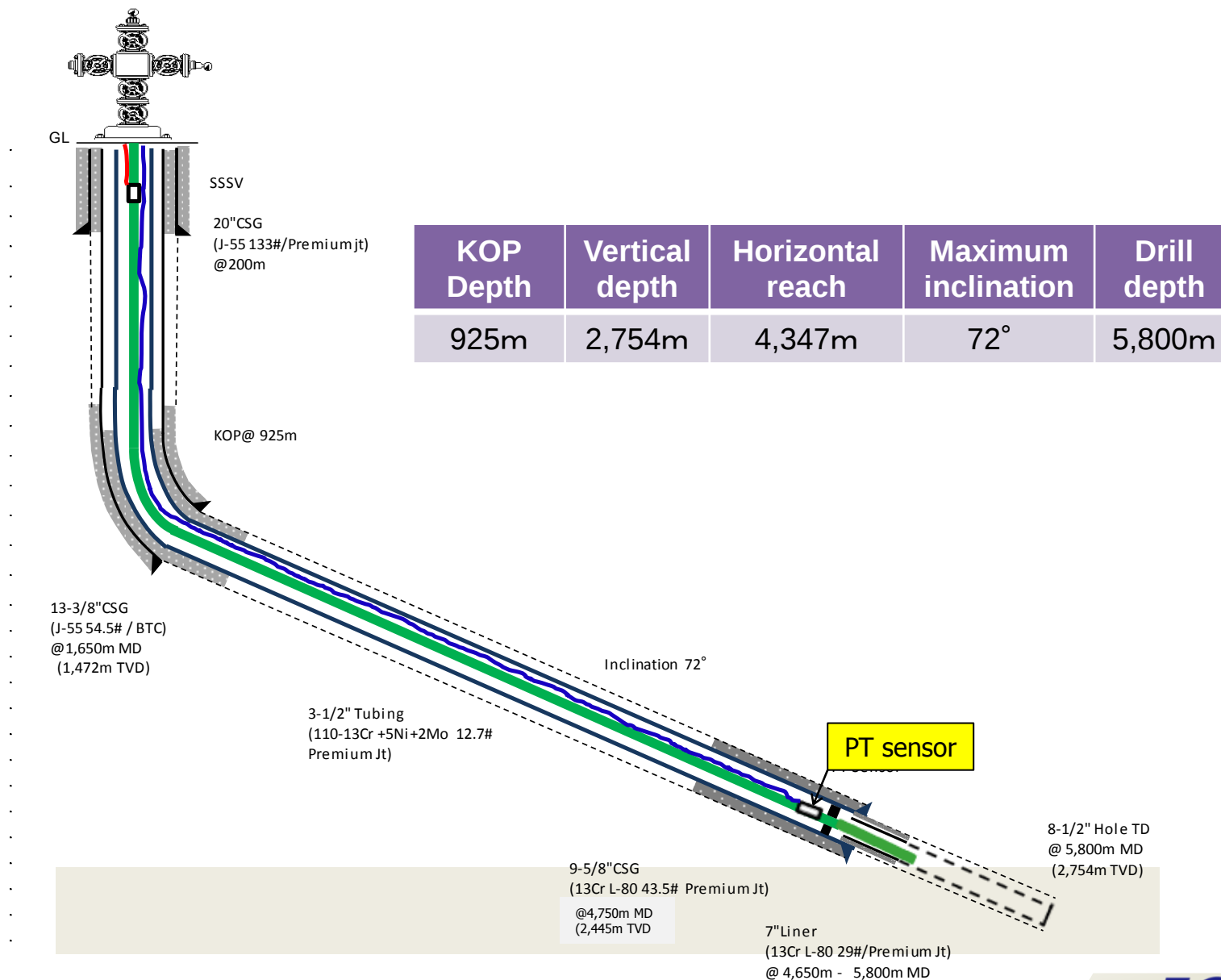


Works in JFY. 2014 and after

- Construction works of the capture and injection facilities start in the first quarter of JFY 2014
- Marine environmental survey (springtime baseline) : May 2014
- Drilling works of two injection wells will be completed in the final quarter of JFY 2014.
- Installation of seismic sensors and PT sensors in three observation wells will be completed by the third quarter of JFY 2014
- Installation of ocean bottom seismometers (OBSs) will be completed by the end of the third quarter of JFY 2014
- Baseline observations of seismicity and the reservoirs' temperature and pressure will start at the end of JFY 2014
- The commissioning of the capture and injection facilities is targeted to start in the third quarter of JFY 2015

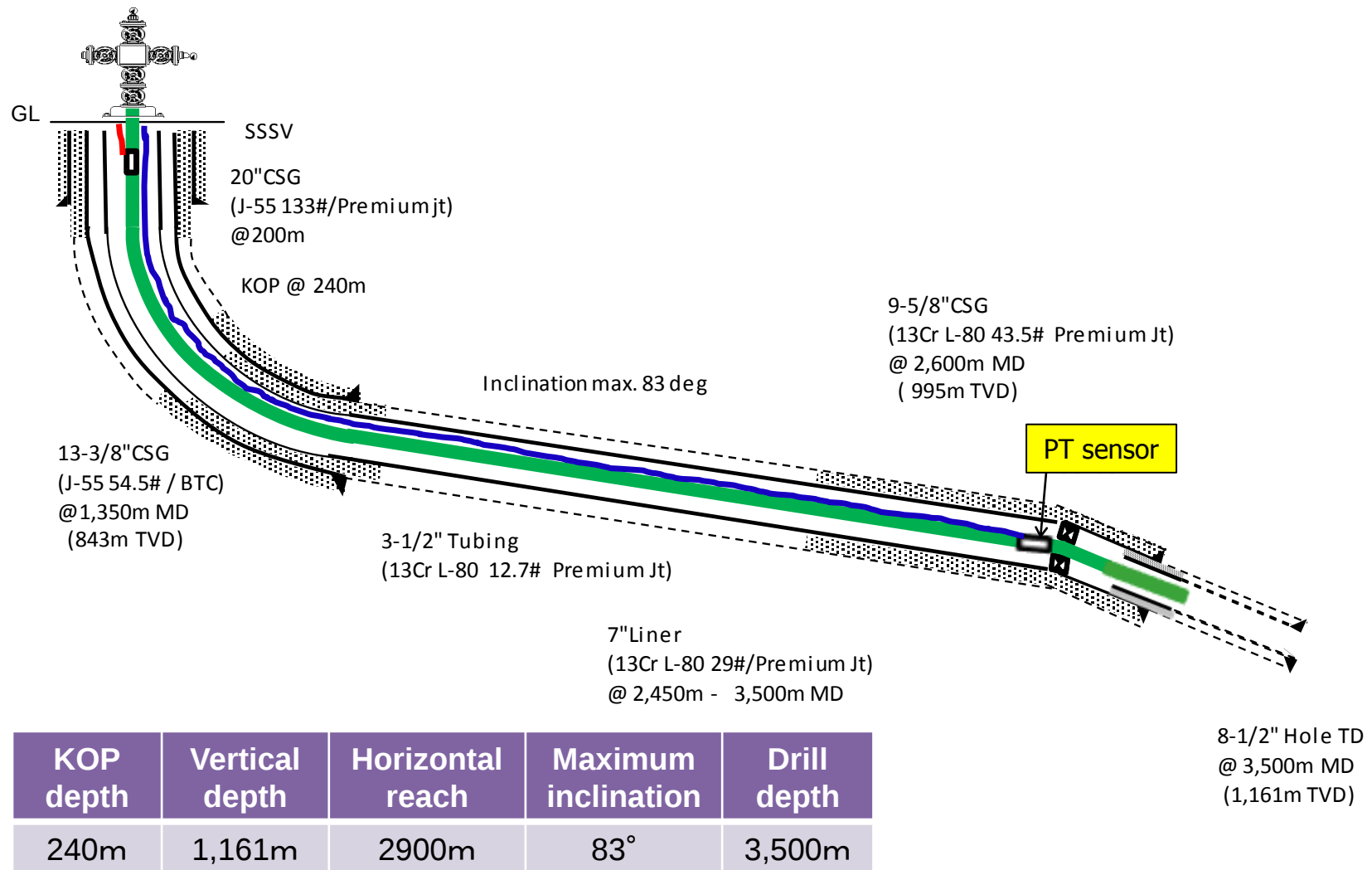
Injection well for Takinoue Formation

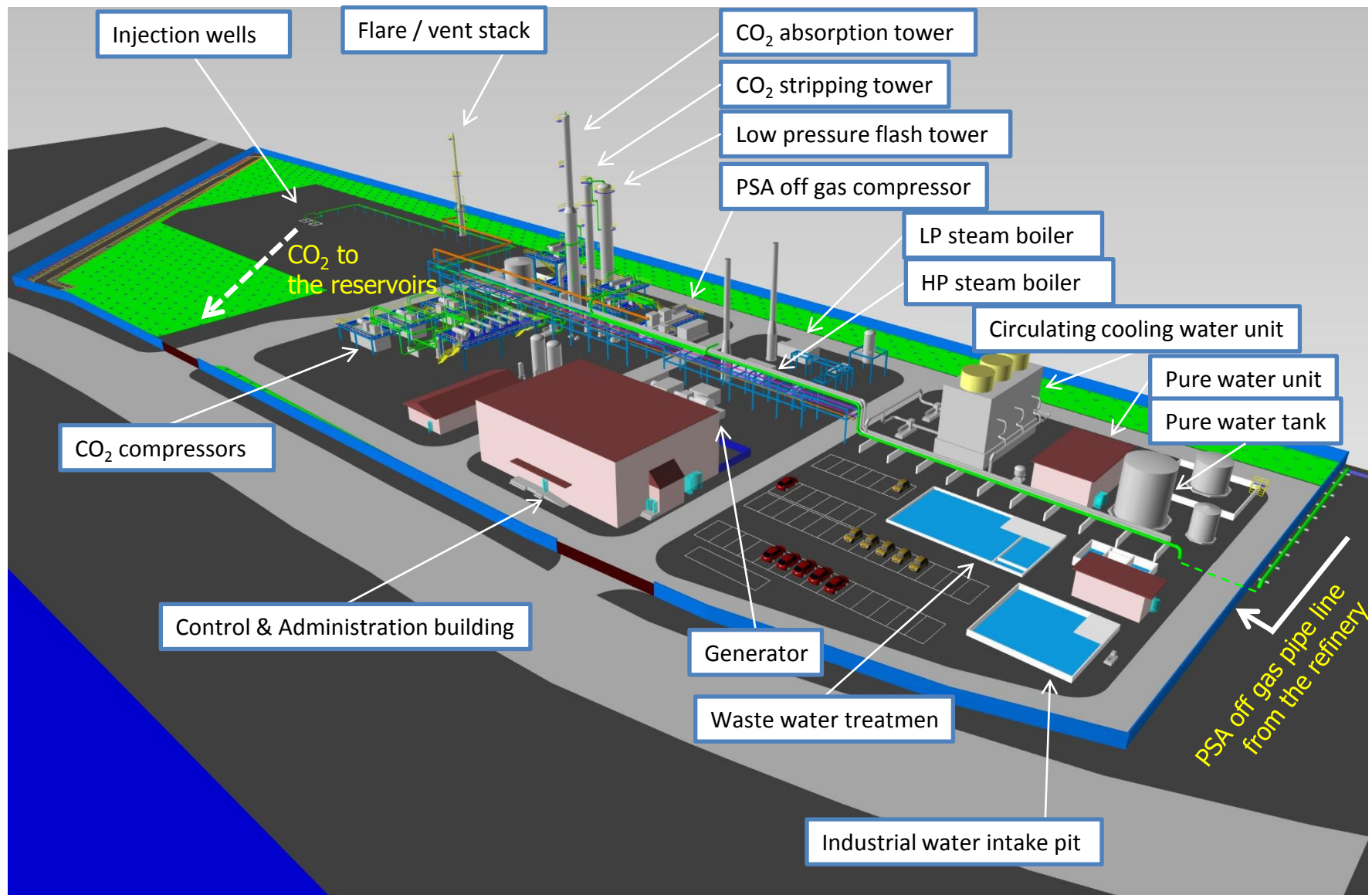
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Injection well for Moebetsu Formation

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Thank you for your attention !

