TRUST

High resolution monitoring, real time visualization and reliable modeling of highly controlled, intermediate and up-scalable size pilot injection tests of underground storage of CO_2

Contract #309067

Deliverable Number	**D2.2**
Title	**Report describing the installed facilities for CO_2 injection at Heletz Facility**
Work-Package	**WP02**
Lead Participant	**EWRE**
Contributors	**J. Bensabat, EWRE** **R. Ronen, EWRE**
Version:	**1**
Revision level:	**01**
Due Date:	**Month 18**
Reviewed by:	
Status:	**FINAL**
Dissemination level	**PU**

Executive summary

This deliverable presents the progress in preparing the Heletz site for CO_2 injection, the facilities and materials and addresses health and safety issues. The commissioning of the CO2 injection system is completed, after we have identified a number of issues that needed to be redressed.

The downhole sampling system, the U-tube, protocols are updated. The Utube sample reception panel in the control room was amended in order to improve the quality of the samples and of the sampling procedure.

Substantial effort has been invested in granting safety. A health and safety plan (HSP) has been prepared. A leakage monitoring system was installed. It comprises outdoor gas detectors, personal gas detectors and gas detectors in the control room. Safety distance between the various facilities onsite were set in order to allow smart planning, as a response to the fire department requirements, and a HAZOP document.

Keywords	Project commissioning, safety, preventing actions, HAZOP, CO_2 injection.

Table of Contents

List of figures

List of Tables

1. Introduction

This document describes the facilities installed at the Heletz experimental CO_2 injection site and the experimental capabilities that they enable.

The Heletz site is located in the Southern Mediterranean Coastal Plain of Israel, about 8 km to the east of the city of Ashkelon. In the frame of the EU-FP7 MUSTANG project, two deep wells have been drilled and instrumented: H18A is instrumented for CO_2 injection, water injection, and fluid abstraction and monitoring, H18B is instrumented for fluid abstraction and monitoring. Monitoring technologies installed in the well include downhole pressure and temperature transmitters, an optical fiber for continuous temperature sensing and TiT (tube in Tube) downhole fluid sampling device. In the frame of TRUST we have substantially improved the facilities above the ground such as a versatile CO_2 injection system, onsite sampling and chemical analysis, tracer injection.

We also present the progress made in preparations towards the injection of CO_2. Herein, we depict a broad picture of the site and all its facilities and process lines (P&ID) a better understanding of the project's site capabilities. We focus on the facilities and materials on site and safety issues, especially on hazard prevention and control.

2. Objectives

At Heletz site a series of sizeable, pilot scale and highly controlled, CO_2 injection experiments are planned.

Some of the experiment goals are mainly scientific, and are listed below:

- Assess the characteristics in a field scale experiment of CO_2 trapping, e.g. solubility and residual saturation.
- Assess the effect of heterogeneity on these parameters.
- Generate a complete set of data for calibration and verification of computational models to simulate CO_2 storage.
- Estimating CO_2 mixing in the storage by using tracers that will assist in optimizing the ratio of dissolved CO_2 in the reservoir, and determining the storage efficiency of the reservoir.
- Test a number of injection strategies (cold CO_2 versus supercritical CO_2).

These objectives will be achieved by conducting a single well push-pull injection of pure CO_2, single well push-pull injection of CO_2 and impurities (SO_2 and N_2), a dipole experiment (injection of CO_2 in the injection well and abstraction at the monitoring well, injection of cold CO_2, injection of CO_2 aimed at testing optimized injection strategies. I each experiment, we plan to inject the amount of CO_2 that would allow obtaining relevant reservoir responses and the ability to extrapolate results and conclusions to larger, industrial-scale injection activities.

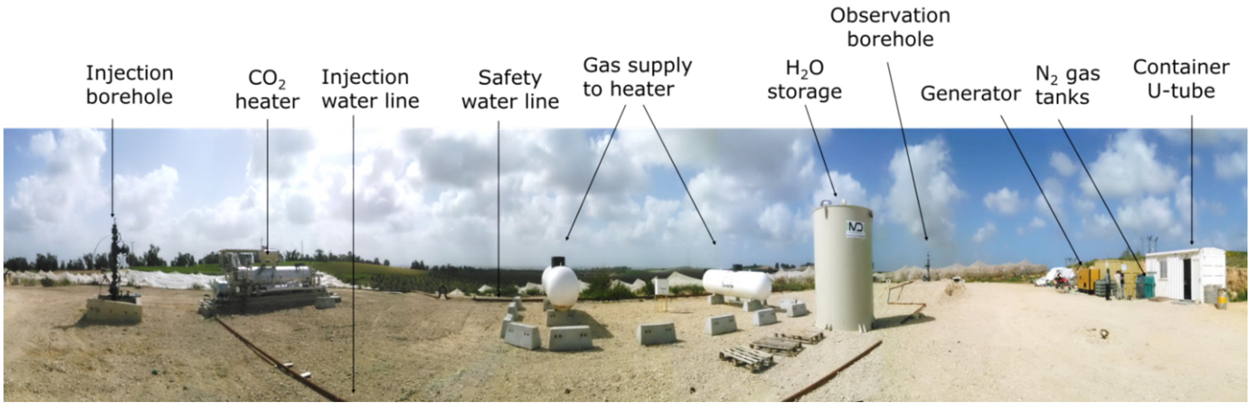


Figure 1: Panoramic photography of the experiment site (February 2015).

3. The Heletz site

The site is located at the edges of an almost depleted oil field, which was discovered in 1955. The site was extensively explored for oil by means of a relatively large number of deep wells over a relatively small geographical area. For this reason, the site geology is well characterized: the reservoir rock, the "Heletz sands" is a sandstone formation composed of three sublayers (K W and A). At the site vicinity, the cumulative thickness of the reservoir is of approximately ten meters, the porosity is of at least 20% and the permeability of ~750 mD. Above the reservoir, there is a sealing cap rock is made of limestone, shale and marl, with a thickness of approximately forty meters.

The Heletz site is located in south of Israel. The site coordinates are (166870, 612920), in the New Israel coordinate system. The road's distance of the closest populated area belonging to Hof Ashkelon Regional Council are: Heletz 6.6 km, Kochav Michael 4.3 km and Sderot 11.8 km . The close large cities are Ashkelon 15.8 km and Be'er Sheba 53 km. The site location is advantageous for two reasons: (1) far enough (more than 100 m) from a populated area, thus we stand in the separation distance requirements for the materials in use. (2) Close enough to populated area to enable fast rescue or assistance in disastrous event. For example, the closest hospital is only 19 minutes.

Two new wells were drilled: Heletz 18A (H18A, the injection well) and Heletz 18B (H18B, the observation well). CO_2 is pumped through the skid, heated and then flows through the manifold to the injection well. At 1000 m depth the CO_2 is mixed with a tracer (SF_6). Formation fluids are pumped from the observation well, filtered and stored at the storage unit. When formation fluids are injected, they are mixed with tracers (Xe and Kr), and injected through injection well at 1640 m depth.

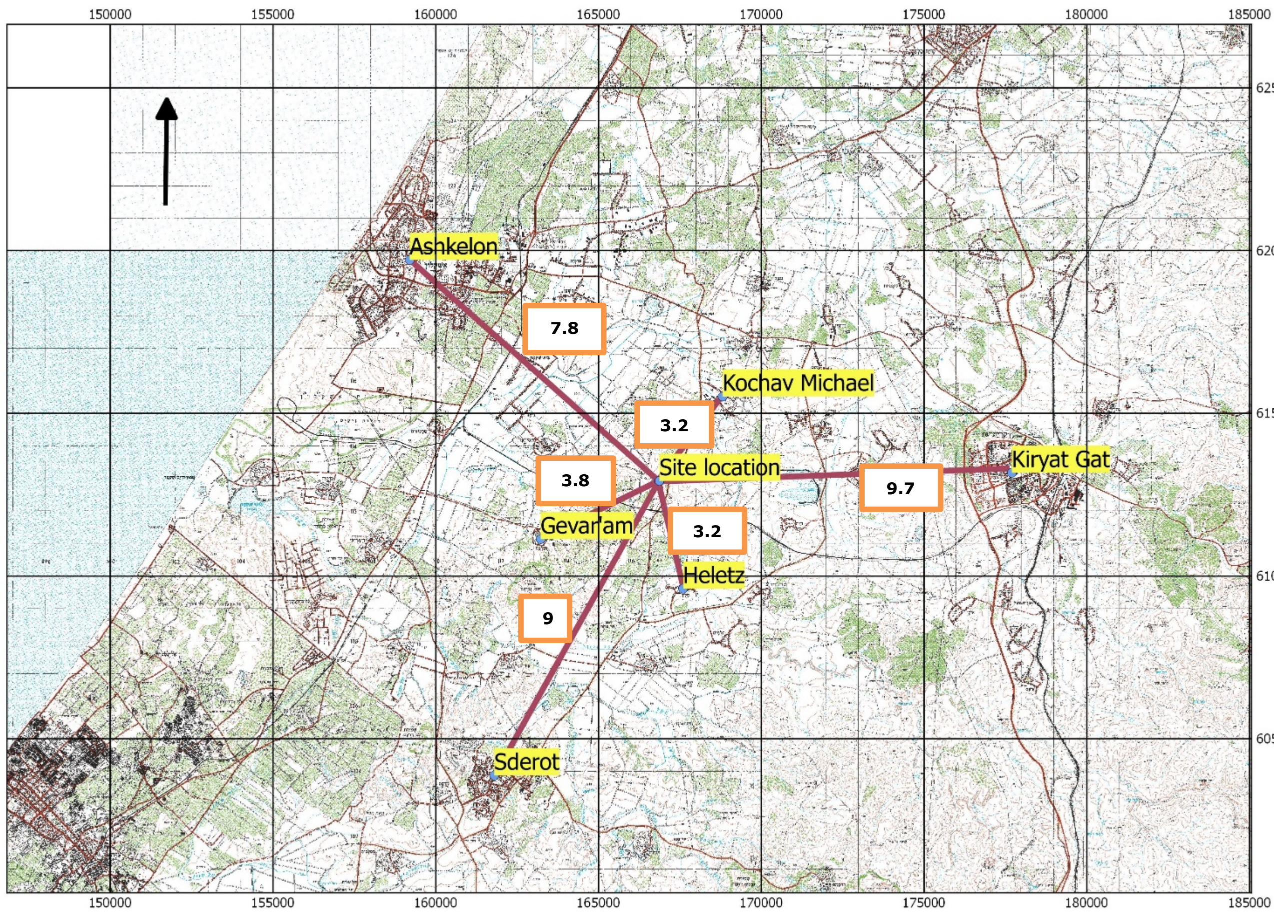


Figure 2. The experimental area map detailing air distances (km) of the nearby towns.

Figure 3. Aerial photograph of the experiment site containing the two wells (H18A and H18B).

4. Underground facilities

- Two deep wells were drilled at the Heletz site, known as H18A, the injection well, (Figure 4) and H18B, the observation well, (Figure 5).
- The wells depth is of ~1650 m, perforated at the target layers and laying between 1620 m and 1640 m. The injection occurs in 1630 m depth, while a sealing cap rock layer of 40 m lies above.
- The well has a typical oil well structure, containing 3 sections: $13^{3/8}$″ diameter casing from the surface to 300 m depth, $9^{5/8}$″ diameter pipe from the surface to 1200 m depth and 7″ diameter pipe from the surface to the target layer. Cementation with CO_2 resistant mix in the lower part was installed under the supervision of Halliburton. The integrity of the inner and deeper cementation was check via a CBL (Cement Bond Log).
- A packer was installed in 1612 m depth and separated the perforation layer from the rest of the injection well. The packer operation was tested for leaks using HRH type FID gas detector and chromatograph. The pressure in the tube was increased to 100 bars and the upper part of the tube was sealed. The pressure in the upper and lower part of the tube was compared, showing the packer was well operating.
- Systems for measuring and monitoring were installed in the wells.

  These include (Table 1):
  - Pressure and temperature sensors.
  - Optical fiber for continuous monitoring of temperature, possibly acoustic measurement (requiring dedicated hardware and software above the ground) and in-situ brine heating system.

- A formation fluid sampling system (U-tube), which produces samples at reservoir pressure (high). The pressurized samples can then be depressurized once the pressure dependent characteristics of the sample are measured.

Table 1. Measuring equipment in the borehole.

Wellhead	From wellhead to well bottom	Well bottom
Pressure sensors Type: Rosemount 2088 with Selectable HART Pressure Transmitter Detection range: 0-276 bar Accuracy: ±0.065%		4 inline electronic pressure sensors in each well Type: Ranger Gauge Systems DASRO Detection range: 100.3-0 bar Accuracy: ±%0.02 Resolution: 0.7mbar
Temperature sensors Type: Rosemount 644 Temperature Transmitter Detection range: -40-85 °C Accuracy: ±0.15 °C	Optical fiber monitoring temperature along the borehole. In case of CO_2 leakage, a temperature drop will be detectable in the optic fiber readings.	4 inline electronic temperature sensors in each well Type: Ranger Gauge Systems DASRO Detection range: 200 °C Accuracy: ± 0.5 °C Resolution: 0.005 °C
The robust borehole head can withstand CO_2 burst. Maximal pressure: 345 bar Maximal flow rate: 4 ton/hr		A packer separates between the well and the wellhead. The packer is placed at 1612m, between outer 7" cylinder and inner $2^{7/8}$" cylinder. In case of leakage the gas will have to diffuse through a long liquid column above the packer.

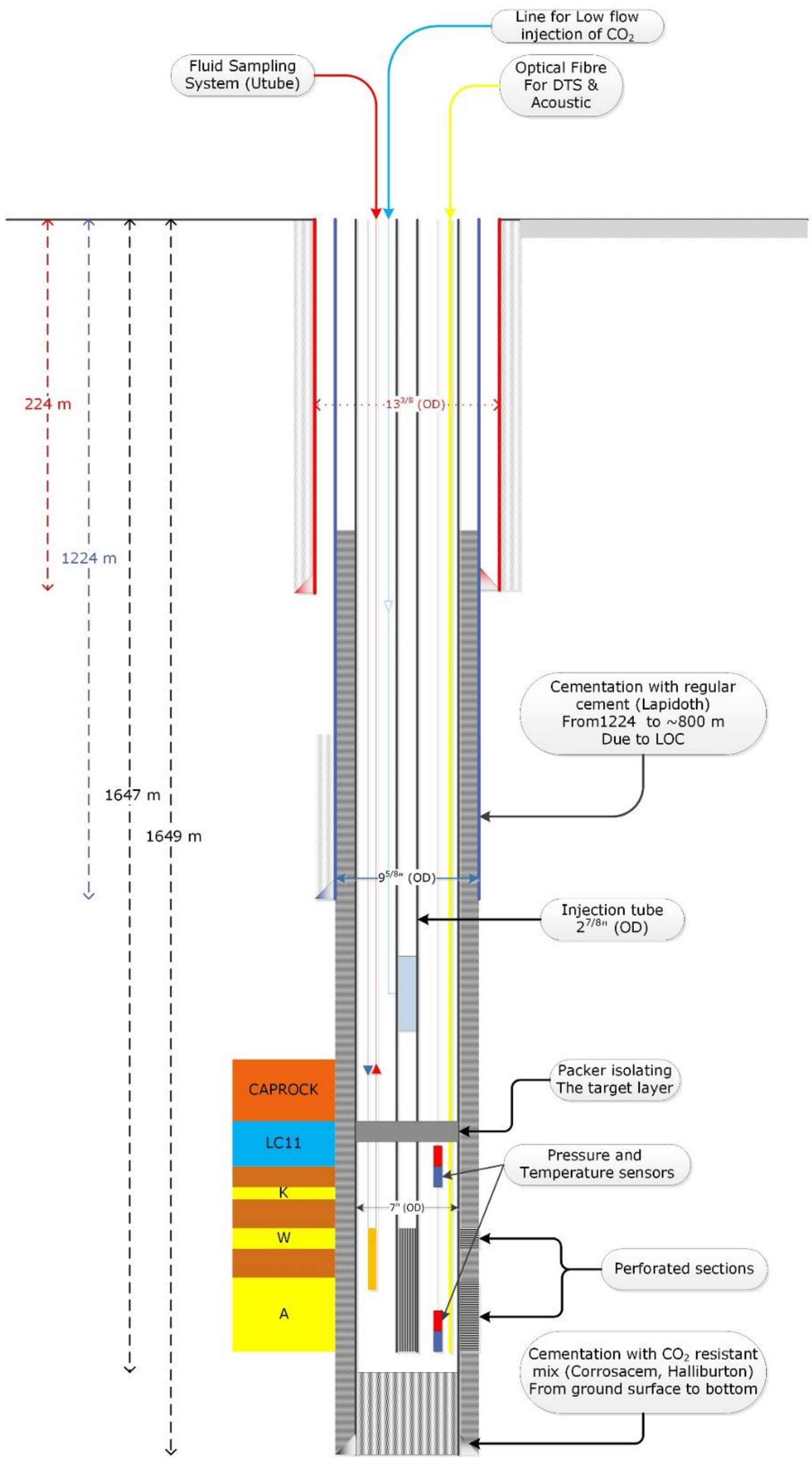


Figure 4. Structure of injection well (H18A).

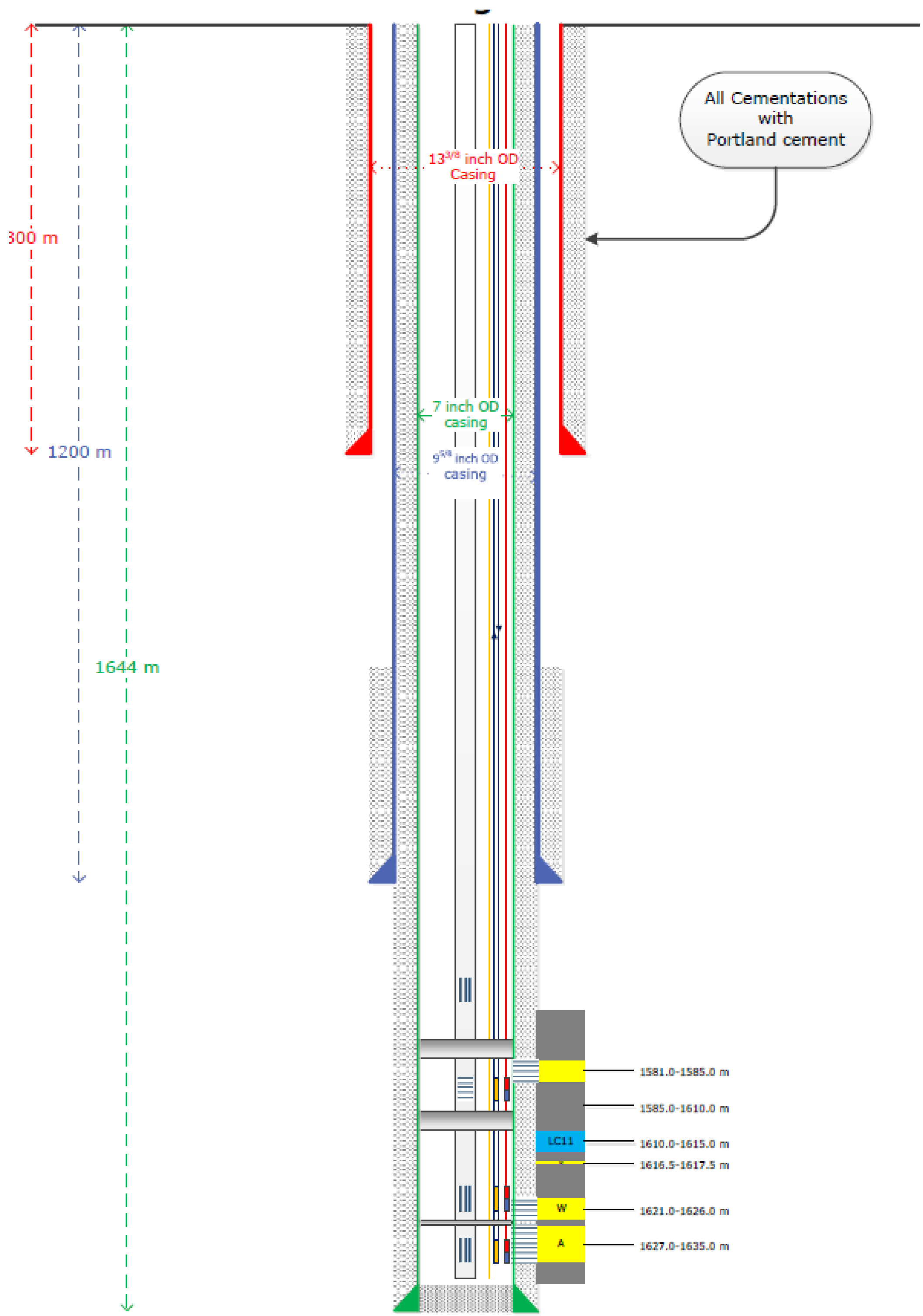


Figure 5. Structure of monitoring well (H18B).

5.Above the ground facilities

5.1 The CO_2 injection system

The CO_2 injection system is composed of a pump skid (Figure 6), a heater (Figure 7) and a manifold. The skid contains a booster, which increases the CO_2 fluid pressure to the working pressure of the pumps, in order prevent the formation of CO_2 as gas. Two main triplex pumps (one smaller – low-flow and one larger – hi flow) are required to cover the full range of CO_2 flow rates (0.25 – 3.96 ton/hr)) for the planned experiments. Each triplex pump can raise the CO_2 discharge pressure to as much as 1,200 psig (83 bar). Afterwards, the CO_2 fluid will flow through a Coriolis meter, which measures the mass flow rate of the CO_2 to be injected. Each pump is connected to a Variable Frequency Drive (VFD), which allows determining the actual flowrate. The liquid CO_2 used as feed is -18 ^{o}C, this temperature will not significantly increase by the booster and main triplex pump, so the heater will be used to heat the CO_2 to temperatures up to 35 ^{o}C, in order to bring the CO_2 to supercritical conditions. The heater burns a mixture of propane and butane inside a fire tube that is immersed in a bath designed to be a 50 / 50 weight percent mixture of water and Propylene glycol. The CO_2 system is designed for unattended operation (A1).

Figure 6. Pump skid.

Figure 7. The CO_2 heater and manifold sections. The manifold is a junction for batch tracers and water tube with CO_2 fluid (black frame). The manifold is connected to the wellhead (black arrow). Tracer injection

Figure 8. The CO_2 system and 22 ton tank (September,2015).

There are two tracer systems:

- **Tracers to be mixed with injected water:** In the push-pull experiment we shall use Xenon and Krypton (Xe/Kr) (Figure 8, Figure 9). Xe/Kr are noble gases, non-toxic and stable in the environment. These tracers monitor leaks and subsurface migration from the reservoir. At the pressure and conditions the supercritical CO_2 becomes gas, Xe/Kr will be released as gas as well (1). A mass flow controller (Sierra) measures the mass flow rate of the injected tracers. This measurement will allow mixing the tracer with the formation fluid at the desired ratio.

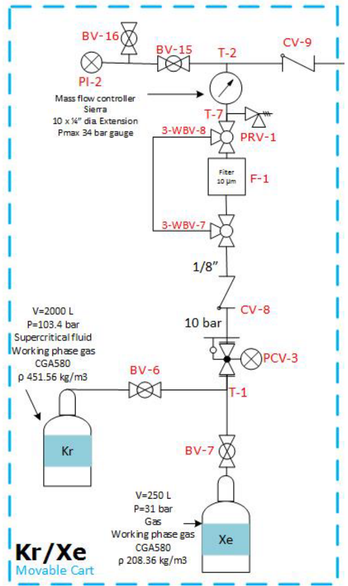


Figure 9. P&ID of Kr/Xe injection system

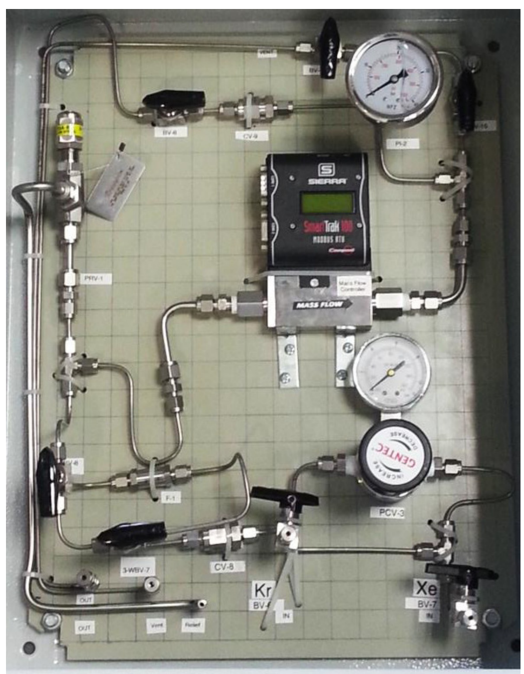


Figure 10. Kr/Xe tracers' system, which is build inside a portable box.

Tracers to be mixed with the injected CO_2: we shall use SF_6. SF_6 is will be pumped using a high pressure metering pump (Eldex), then mixed with CO_2 and injected to 1000 m depth (Figure 10). Sulfur Hexafluoride is a colorless, odorless, non-toxic, nonflammable, liquefied gas. The main health hazard associated with releases of this gas is asphyxiation, by displacement of oxygen, but working in an open field significantly reduces the danger.

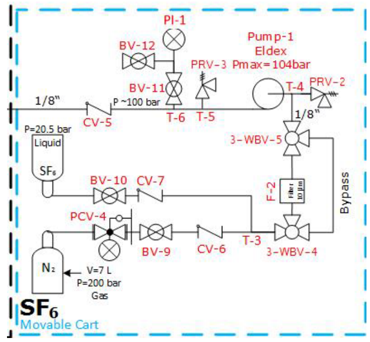


Figure 11. P&ID of SF_6

Figure 12. Tracer's system while it was under construction.

5.2 Water Abstraction

It is possible to perform fluid abstraction from the reservoir formation via air-lift. Abstraction can be done from both the injection and monitoring wells. To this end, we have an air compressor (Bauer Model I230 delivering a pressure of up to 345 bar and an air flowrate of 1.36 m^3/min). In both wells, there is a gas-lift valve at a depth of 1,000 m. Compressed air is flowed in the well annulus until it fills the space to the depth of the gas lift valve. Once the air penetrates the tubing, the abstraction starts. The flowrate of the water will depend on the flowrate of the penetrating air. The produced fluid will comprise in addition to the formation water, CO_2, residual oil and solid particles (as the reservoir is poorly consolidated). First, this mixture will be flowed through a series of decantation tanks, in order to separate the large particles and the oil residues from the water. Then, if the produced water is needed for the purpose of injection, it will be flowed through a sand filer for the removal of fine solid particle and after that to a 15 m^3 storage tank. The water to be injected from this tank will then be passed through a UV filter (for the removal of bacteria) and to though a chlorinator. The later perform a hydrolysis, using the rich chloride content of the water to from chlorine, which is a biocide. This would prevent the bacterial formation at the well bottom, in case the injected water is rich in oxygen or any other component susceptible of inducing this development.

5.3 Mixing of impurities

5.3.1 The SO_2 injection system

This system allows injecting liquid SO_2 to the well through the chemical injection line (CIL), which is connected to the tubing at a depth of 1000 m. This system is developed in the frame of the EU funded CO2QUEST project and is integrated into the site facilities. It contains a recovery vessel and automatic valve for safety reasons, and a Coriolis flow meter to measure the mass flow rate to allow maintaining the desired SO_2/CO_2 ratio.

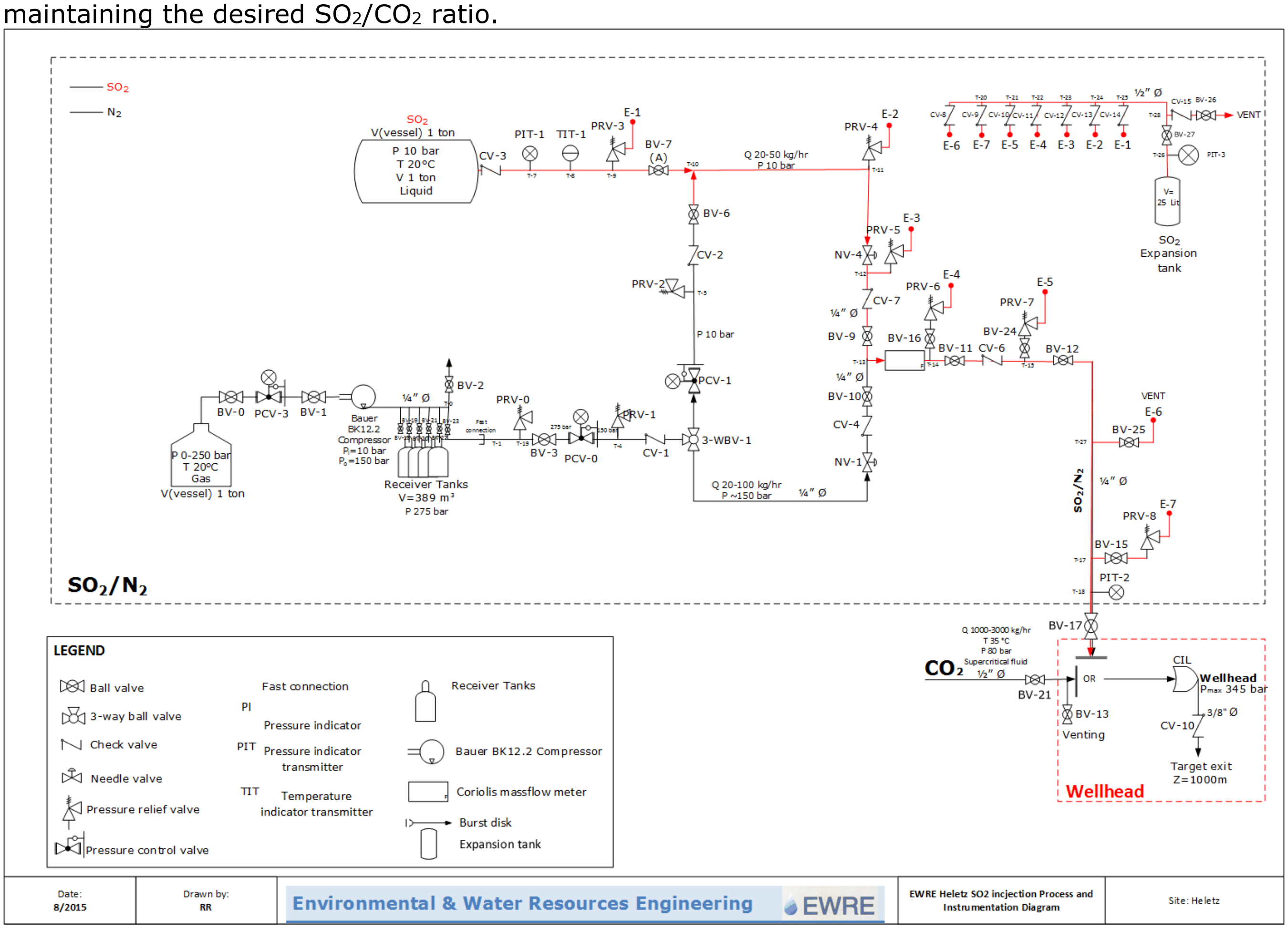


Figure 13. P&ID of SO_2 and N_2 process lines.

5.3.2 The N_2 injection system

The system has three purposes:

(1) Push the remains of the tracer gas into the well (Figure 10). After operation of the tracer's injection system of SF_6 is over, some gas remains in the tubes. For cost effective operation, N_2 is used to purge the SF_6 injection system.

(2) Purging the SO_2 process lines to remove water residues, prior to SO_2 injection. Water molecules and SO2 interact and cause corrosion. When the process of SO_2 injection is over, N_2 is used to push the remains to the wells, thus reduces the chance of unnecessary exposure (Figure 11).

(3) N_2 gas is used as an impurity of CO_2. It is compressed to 150 bar and injected to 1000 m, where it mixes with CO_2.

5.4 The Control room

The control room serves as a chemical laboratory, containing a U-tube control panel (Figure 12), a mass-spectrometer, pH meter, conductivity meter, CO_2 partial pressure measurement and temperature analyzer. The U-tube system can sample inline both in high and low pressure conditions. Low pressure samples can be sent to be measured in external laboratories. The control room contains computers to which the measurement devices in the well are connected (Table 1).

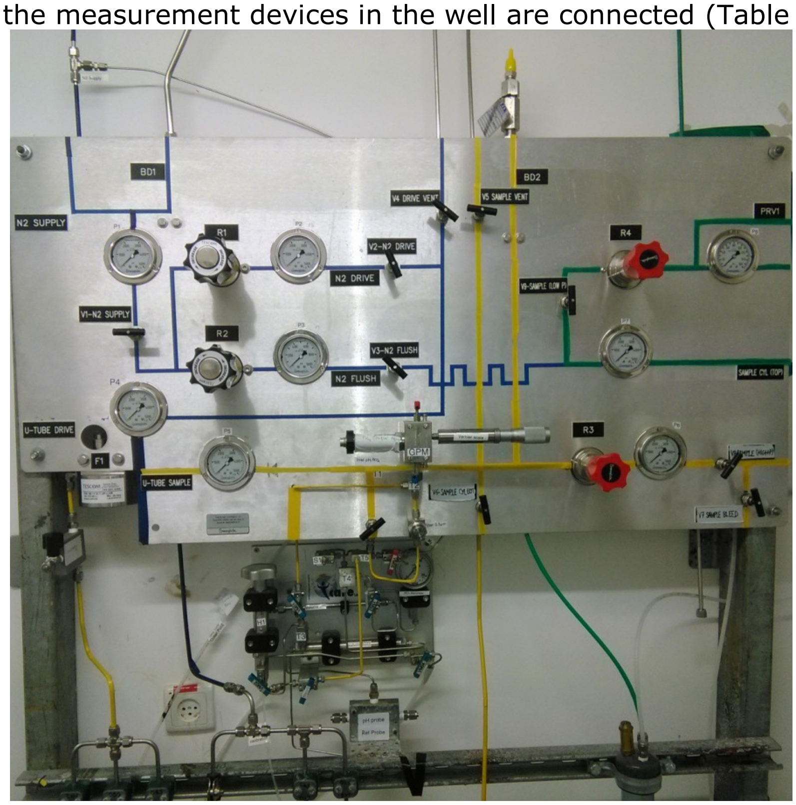


Figure 14. The U-tube control system that enables sampling the formation fluid.

5.5 Materials on site

The state of Israel grants toxic substances permits for material handling. Each material is regarded as toxic, and its storage requires prior authorization. The toxic permit request contains MSDS of the materials, statement on the materials' handling equipment, stating the site location, details on the responsible of hazardous material, business license, statement of truth of the supplied information, list of the materials on site and maximal amount usage, Home Front Command approval, Fire department approval and Ministry of the Environment approval. Both the Ministry of the Environment and the Fire department personnel have had a tour on site to get acquainted with the experiment.

In Heletz we plan to make use of chemicals as presented in Table 2.

CO_2 is used for injection, N_2 is used for purging and as impurities of CO_2 stream, SF_6 is used as a tracer of water (injected with CO_2), Kr and Xe are used as tracers of water, LPG used for the CO_2 heater, and SO_2 used as impurities of CO_2 steam.

Table 2. Materials used on site.

Material + CAS NO.	**UN Number**	**Emergency Action Code (EAC)**	**Tank volume**	**Status**
CO_2 (124-38-9)	1013	2RE	30 ton (1,000 ton per year)	Under renewal
N_2 (7727-37-9)	1066	2T	192 m^3 (28 cylinders, 200 bar)	present
SF_6 (4-62-2551)	1080	2TE	5.9 kg (5.9L, 20.3 bar)	present
LPG	1075	2WE	2 ton (2 tanks, each 1 ton)	present
Xe (7440-63-3)	2036	2TE	1.72 kg (250L, 32.65 bar)	present
Kr (7439-90-9)	1056	2TE	5.4 kg (15.7L, 102 bar)	present
SO_2 (7446-09-5)	1079	2RE	1 ton (liquefied, 5 bar)	To be delivered as close as possible to target date.

6. Safety

The site's safety was inspected by the Israeli Ministry of the Environment and the armies' Home Front Command. The site's fire safety was approved by Israeli Fire department. These regulatory requirements for safe operation of the site were fulfilled. Furthermore, the site's health and safety plan is being written, and will be read by the site operators beforehand.

The equipment on the site includes hamlets, safety glasses, ear plugs, first aid kit and gloves.

6.1 Leakage check

The process lines are checked for leaks prior to the experiments, as elaborated below.

- **CO_2 process line:** following the protocols of Trimeric Company, the system is checked for high and low pressures with N_2 and CO_2. Leaks were observed by sound test, using a soap solution distributed on all elements and connections, and by pressure indicators indicating a pressure drop on a close section of the pipe.

- **CO_2 process line:** It is usually recommended to use ammonium hydroxide (NH_4OH) fumes, due to the material toxicity we shall use soap solution to detect leaks.

- **Tracers' process line:** nitrogen (N_2) or water, depending on the tracer's phase, would be used to test the process line for leaks.

6.2 Fire safety

The following equipment was installed on site, according to a fire survey and the Israeli Fire department demands.

- Smoke detection system connected to a caller in the control room.
- Automatic smoke detection and fire distinguisher system in the electricity container room connected to a caller.
- Fire detection and alarm system containing siren and lights outside the control room.
- Powder fire extinguisher 50 kg in control room.
- Halon fire extinguisher 3 kg in control room.
- 2 hydrant 2" on 4" line around the site.
- 2 fire cabinet near the hydrants containing: 2 nozzles 2" and 1 Powder fire extinguisher 6 kg.
- The fire cabinet closer to injection well contains: 1 reel ¾" with length of 25 m.

The water for the fire distinguishers is supplied from the water pipe surrounding the site's ground (

Figure 13).

Figure 15. For fire safety reasons, a water pipe line surrounds the site. Two hydrants are installed on the pipe and near them a fire cabinet (cannot be seen in the image).

6.3 System failures inside the well

In case of system malfunction inside the well, i.e. high pressures, safety valves allow disconnection of the wellhead from the entire well (Figure 14). The wellhead stands a maximal pressure of 5000 psi and contains both operational and safety valves.

Figure 16. Wellhead of the injection well H18A.

6.4 A map of facilities on site

A map of distances between facilities was generated to assist in planning the site, mapping the underground electric and pipe lines and setting the safety margins (Figure 15). The wellhead stands a maximal pressure of 5000 psi and contains both operational and safety valves.

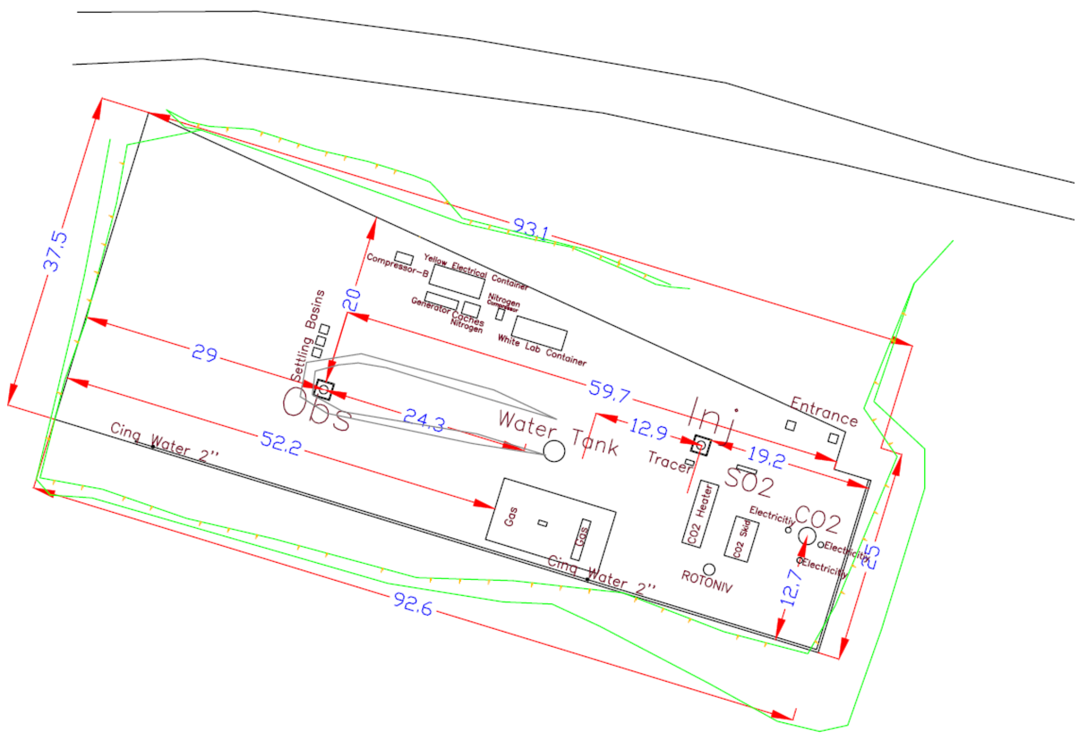


Figure 17. Facilities on site map.

Distance from LPG tanks

The LPG tanks are regarded as an explosive hazard. In case a fire, the other facilities on sites, especially the pressurized tanks, are at risk of eruption as well. Therefore, the distance of other facilities from the LPG tanks is interesting for safety reasons.

Distance from LPG tanks[1] to

CO_2 tank – 20 m
SO_2 tank – 18 m
Injection well – 15 m
Observation well – 34 m
Control room (white container) – 21 m
Electricity container (yellow) – 30 m
Generator – 31 m
N_2 cylinders – 27 m

[1] The distance from the flammable LPG tanks is measured from the tank closer to the measured object.

6.5 Gas detectors

There is a gas detection system inside the control room, located near the U-tube system (*Table 3*, Figure **18**). The sensors are connected to a panel presenting the gases concentration and an alarm system (Figure **18**). When the alert siren is heard, a light (red/orange) can be seen from outside of the container.

Table 3. The alarm concentration setup.

Gas	Range	Alarm 1	Exposure time	Alarm 2	Exposure time
O_2	0-25%	19%	Full work-shift (19.5%). exposure	18%	
CH_4	-	20% (V/V, LEL)	No limitation (Flammable)	40% (V/V, LEL)	No limitation (Flammable)
CO_2	0-5000ppm (5000 ppm – 8 hrs OSHA)	1500ppm	No limitation	3000ppm	No limitation
SO_2 (+H_2S)	0-5 ppm	2ppm	8 hour TWA[a]	5ppm	15 min[a]/ 8 hour TWA[b]

a. HSE, 2002. Occupational Exposure Limits 2002. HSE Books, Sudbury.

b. OSHA Guidelines Website

6.5.1 CO_2 gas detectors

Personal CO_2 detectors (Dräger PAC 7000) were recommended by Trimeric, which designed the CO_2 process. Two outdoor stationary gas sensors were installed near the CO_2 skid and heater. Both are connected to a sound alarm on the CO_2 skid control board.

6.5.2 SO_2 gas detectors

We consider the possibility of purchasing a stationary outdoor gas sensor to detect leaks and install near the SO_2 system. The alert will be set to 2 ppm and 5 ppm (Table 3).

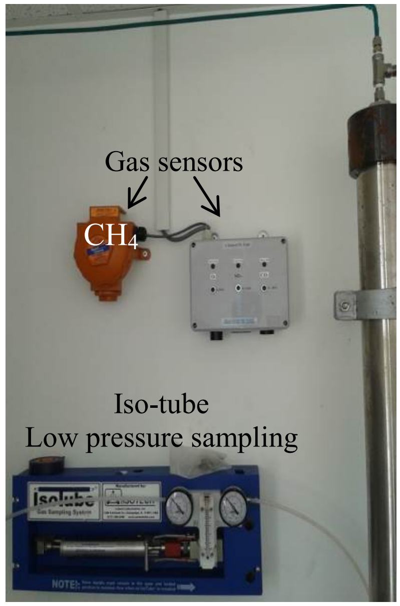


Figure 18. Gas sensors in the control room (white container) and the Iso-tube system designed for taking low pressure brine samples.

Figure 19. Entrance to the control room (white container).

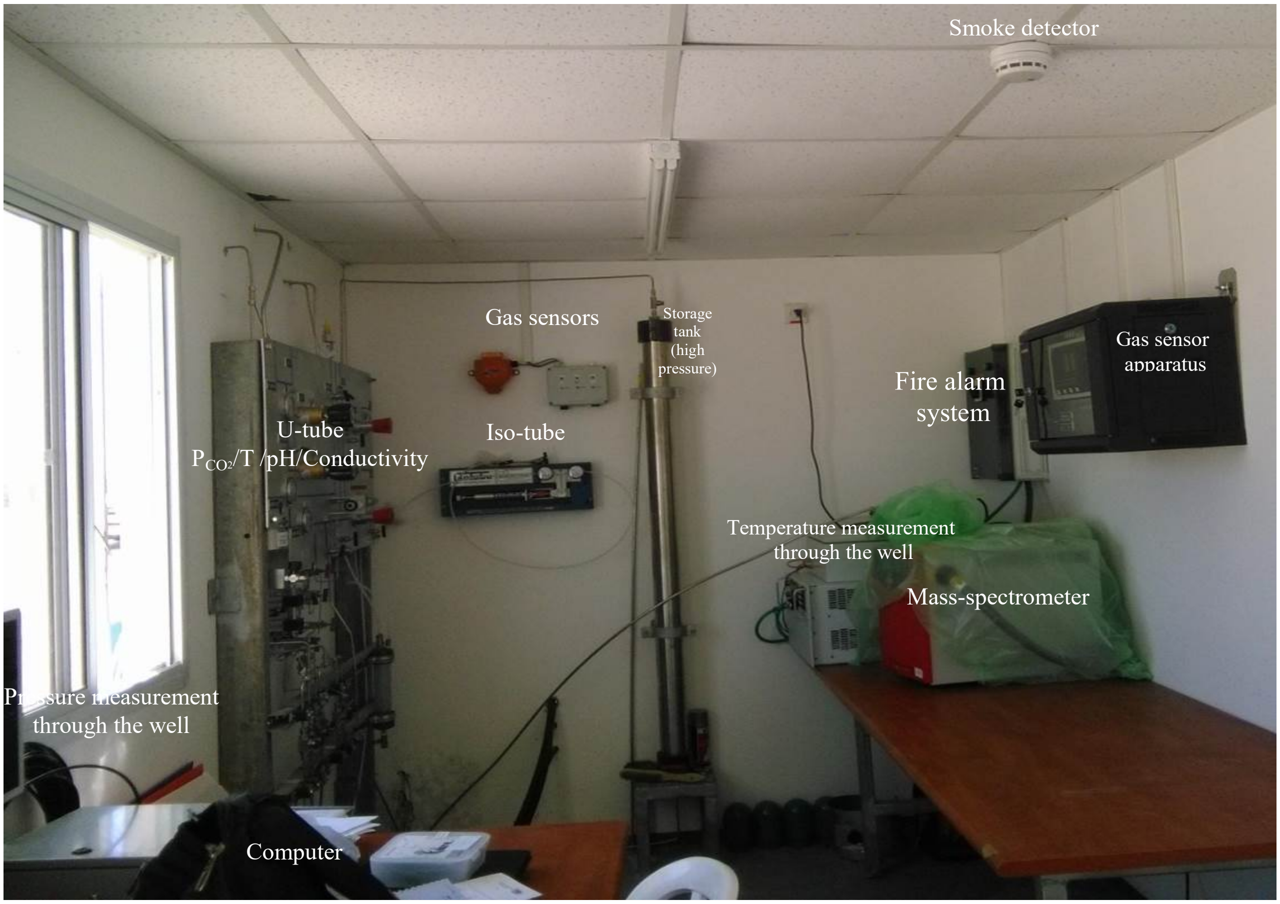


Figure 20. Control room (white container) contents.

7. Current state of progress

7.1 Current stage: preparation of the site for the experiment

- The current stage involves getting the CO_2 injection system running smoothly without any leakages. The system was recently tested for leaks using CO_2 (Figure 19), and the required components to be replaced.
- Configuring the sensors and devices in the chemical laboratory (white container) for the different experiment steps.
- Getting the online visualization website ready for the presentation of real-time and historic plots of the different parameters examined in Heletz experiment.
- Completing the Health and Safety plan.

Figure 21. System check of CO2 system.

7.2 Next stage

By completing the prior step, where CO_2 and water are injected, then a more realistic situation would be simulated. In a controlled manner, SO_2 impurities will contaminate the CO_2 stream and both will be injected into the target layer. Currently, we develop the process lines, safety equipment and protocols for dealing with SO_2. These do not prevent the CO_2 injection to take place.

8. Conclusions

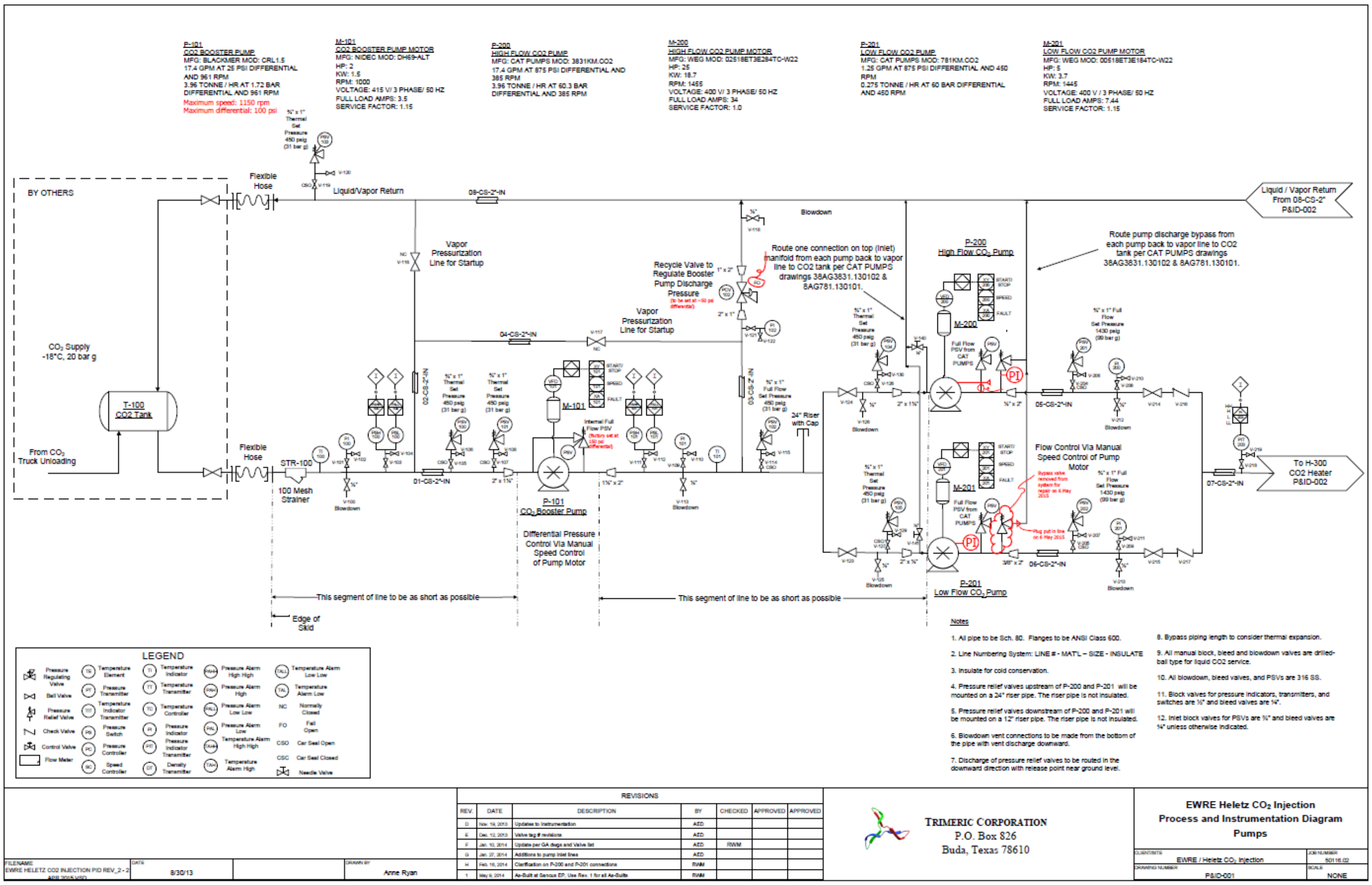
The preparations for the experiment at Heletz site are in their final stages. All the facilities for injecting CO_2 are installed. Most of the materials are already waiting on site, except for CO_2 and SO_2 that will arrive as close as possible to the experiment date to avoid unnecessary risk. The SO_2 process planning and hazard and operability study (HAZOP) are underway. In the planning and construction of the site, the protocols and safety issues were carefully considered. Risk preventing actions were taken, which include leakage tests prior to system operation, constructing the site's health and safety plan, updating the facilities distance map for smart planning, following the fire department requirements, planning and purchasing personal and stationary gas detectors. After the completion of the final preparation the site would be ready for the CO_2 injection.

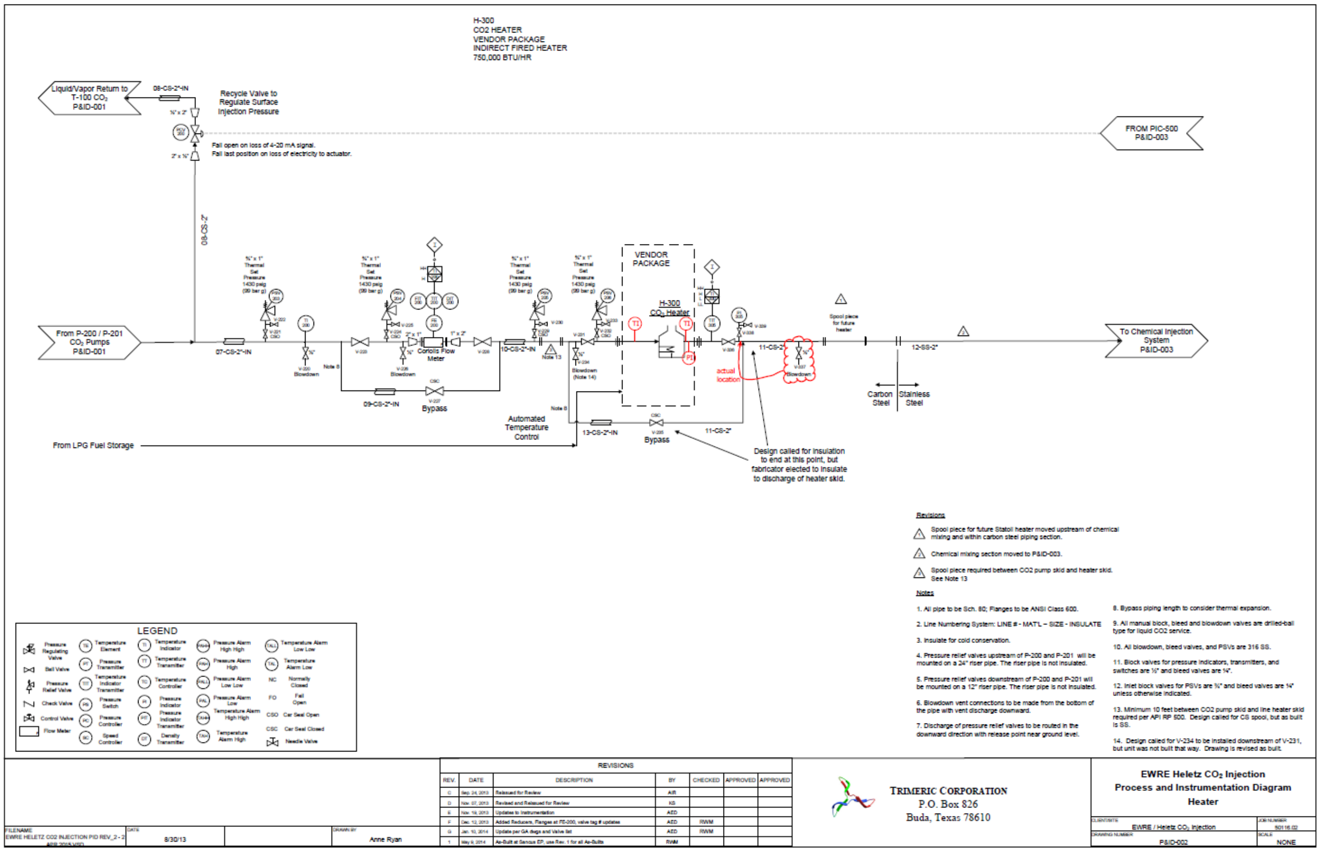
9. Reference

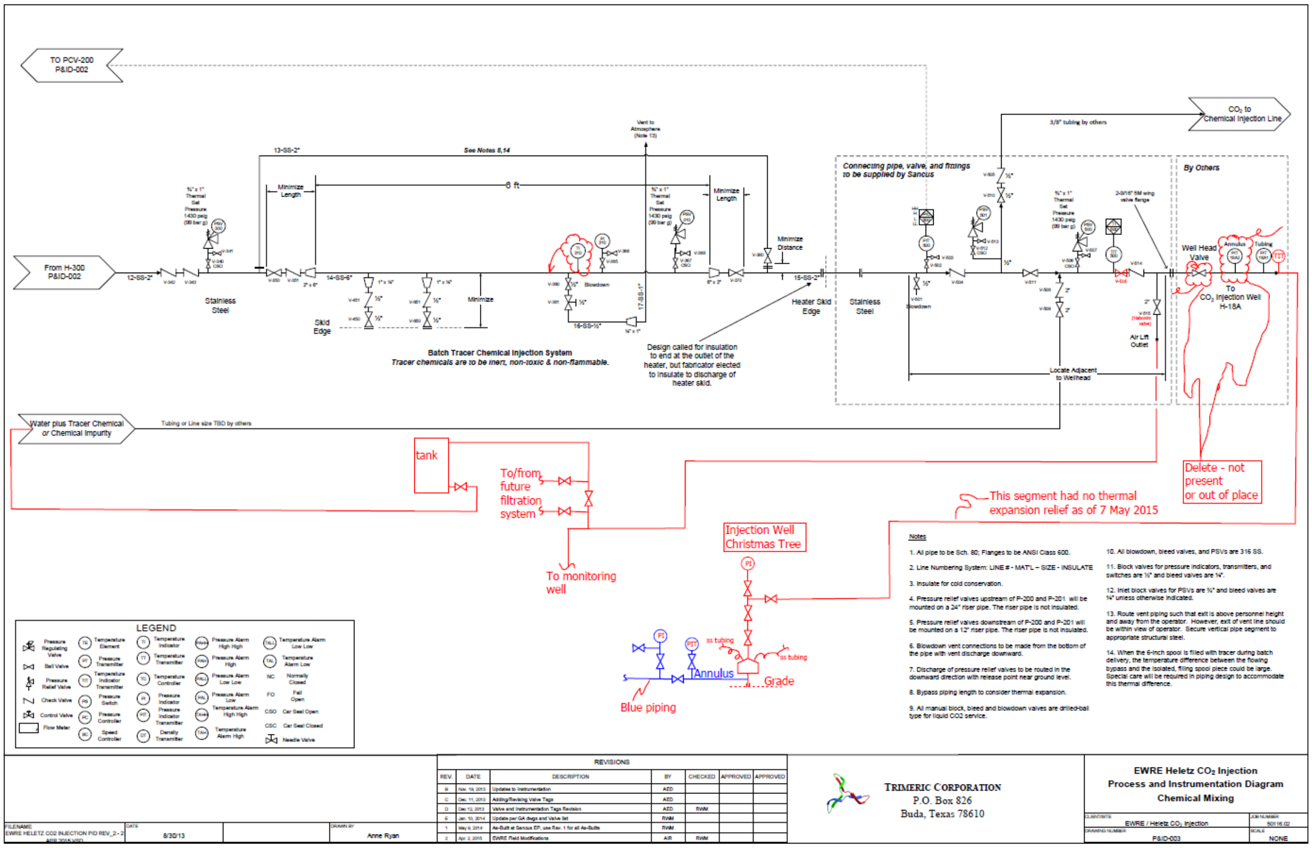
1. Thomas, David C., and Sally M. Benson, eds. *Carbon Dioxide Capture for Storage in Deep Geologic Formations-Results from the CO2 Capture Project: Vol 2-Geologic Storage of Carbon Dioxide with Monitoring and Verification*. Elsevier, 2015.

10. Annex

A1: P&ID of CO2 process lines






TO PCV-200
P&ID-002
CO₂ to
Chemical Injection Line
From H-300
P&ID-002
Stainless
Steel
Skid
Edge
Batch Tracer Chemical Injection System
Tracer chemicals are to be inert, non-toxic & non-flammable.
Design called for insulation
to end at the outlet of the
heater, but fabricator elected
to insulate to discharge of
heater skid.
Heater Skid
Edge
Connecting pipe, valve, and fittings
to be supplied by Sancus
By Others
Well Head
Valve
To
CO₂ Injection Well
H-18A
Locate Adjacent
to Wellhead
Water plus Tracer Chemical
or Chemical Impurity
tank
To/from
future
filtration
system
To monitoring
well
This segment had no thermal
expansion relief as of 7 May 2015
Delete - not
present
or out of place
Injection Well
Christmas Tree
Annulus
Grade
ss tubing
Blue piping
LEGEND
Notes
1. All pipe to be Sch. 80; Flanges to be ANSI Class 600.
2. Line Numbering System: LINE # - MAT'L – SIZE - INSULATE
3. Insulate for cold conservation.
4. Pressure relief valves upstream of P-200 and P-201 will be mounted on a 24" riser pipe. The riser pipe is not insulated.
5. Pressure relief valves downstream of P-200 and P-201 will be mounted on a 12" riser pipe. The riser pipe is not insulated.
6. Blowdown vent connections to be made from the bottom of the pipe with vent discharge downward.
7. Discharge of pressure relief valves to be routed in the downward direction with release point near ground level.
8. Bypass piping length to consider thermal expansion.
9. All manual block, bleed and blowdown valves are drilled-ball type for liquid CO2 service.
10. All blowdown, bleed valves, and PSVs are 316 SS.
11. Block valves for pressure indicators, transmitters, and switches are ½" and bleed valves are ¼".
12. Inlet block valves for PSVs are ¾" and bleed valves are ¼" unless otherwise indicated.
13. Route vent piping such that exit is above personnel height and away from the operator. However, exit of vent line should be within view of operator. Secure vertical pipe segment to appropriate structural steel.
14. When the 6-inch spool is filled with tracer during batch delivery, the temperature difference between the flowing bypass and the isolated, filling spool piece could be large. Special care will be required in piping design to accommodate this thermal difference.
REVISIONS
REV. DATE DESCRIPTION BY CHECKED APPROVED APPROVED
B Nov. 19, 2013 Updates to Instrumentation AED
C Dec. 11, 2013 Adding/Revising Valve Tags AED
D Dec 12, 2013 Valve and Instrumentation Tags Revision AED RWM
E Jan. 10, 2014 Update per GA dwgs and Valve list RWM
1 May 9, 2014 As-Built at Sancus EP; use Rev. 1 for all As-Builts RWM
2 Apr. 2, 2015 EWRE Field Modifications AIR RWM
TRIMERIC CORPORATION
P.O. Box 826
Buda, Texas 78610
EWRE Heletz CO₂ Injection
Process and Instrumentation Diagram
Chemical Mixing
EWRE / Heletz CO₂ Injection
50116.02
P&ID-003
NONE
8/30/13
Anne Ryan