Simulation of Casing Failure

Background

Injection well will be used to re-inject scale from produced water (produced water is water produced as part of oil extraction).

The scale is usually classified as a naturally occuring radioactive material (NORM).

NORM waste is difficult (in a regulatory sense) to dispose because the cost of long-term containment is very high.

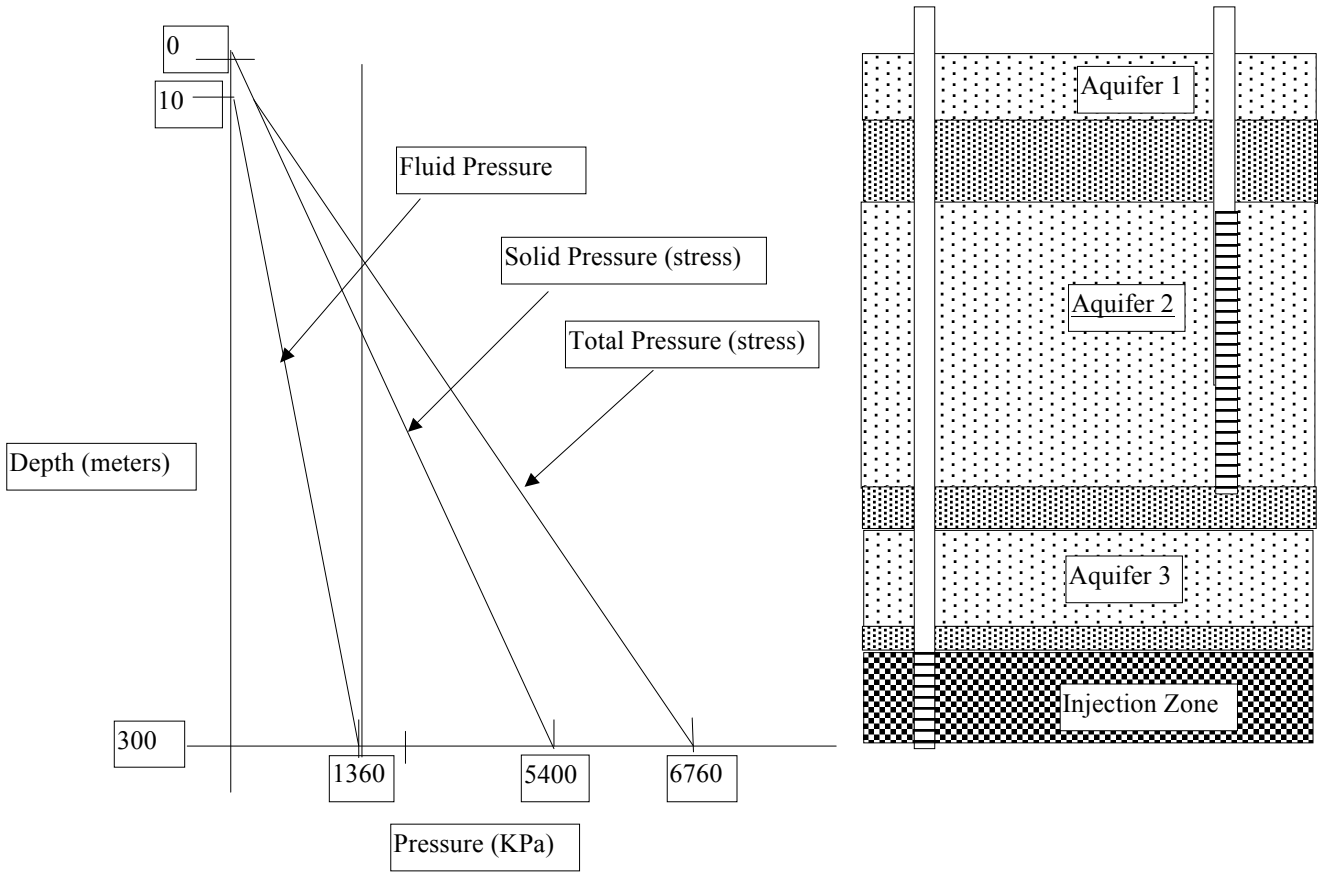
Economically it is preferable to chemically dissolve the scale, which is the significant radioactive source, and inject the solution into a deep reservoir, typically a depleted oil reservoir

Normally injection wells are operated in batches, and would be monitored frequently during the injection process.

A casing failure means that the casing (riser pipe) connecting the surface injection pump to the reservoir is breached in some fashion and water in injected at an incorrect elevation.

A pressure transducer at the injection head would detect the loss of pressure from a casing failure and shut off the injection.

A second kind of failure is poor casing-borehole integrity allowing the injection water to move along the borehole and enter an incorrect elevation.



Mechanical stress on screen = 5400 KPa (~800psi)
Injection pressure > 1360 KPa (~200psi)

Mechanical stress (solid + fluid pressures) on the casing is often very high.

Injection pressures are also quite high to overcome the high fluid pressure in the receiving reservoir (aquifer).

These two situations can combine and lead to casing failure (a rare occurance)

In this project, we will consider only the first type of failure.

As a worst case we will assume that one day's injection volume is lost into Aquifer 2.

Conceptual Model

Aquifer 2 is a confined aquifer of high-quality water, penetrated by the injection well casing and a drinking water well.

Purpose of the model is to determine in a generic case, what the expected concentration of the radioactive material in the aquifer at the drinking water well?

Data Available (Specific Case)

Aquifer maps (Identify physical and hydrologic boundaries)
Driller's logs of the drinking water well and the injection well.(Identify aquifer thickness and material)
Specific capacity tests of the drinking water well.(Transmissivity)
Water level elevations in other wells in the aquifer.
Single well tracer-recovery test for the drinking water well. (Dispersivity)
Well locations.
Injection water composition

Design the Grid

Identify physical and/or hydrologic boundaries in that aquifer being studied. (Use aquifer and area maps - look for rivers that connect to the aquifer, mountains, faults and similar features).