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A Study of Non-Condensable Gas (NCG) Release Controlling at Initial Production Testing through Injecting NCG Accumulation into Nearby Well

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INTRODUCTION

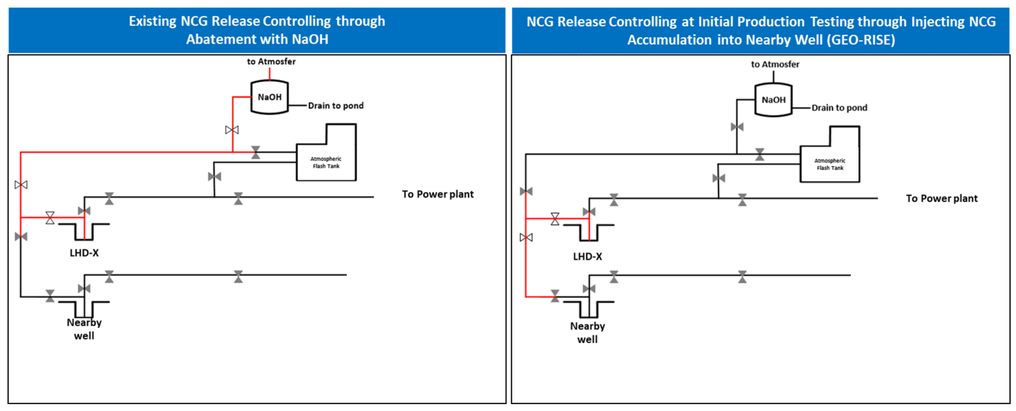
The LHD-X well is a production well located in Cluster ABC, Geothermal Area Lahendong, North Sulawesi, Indonesia. Previously in 2023, a workover activity was carried out on the well. Before the well was opened to supplying steam to the existing unit, a series of production test activities are planned to be carried out.

Usually during static phase, a shut-in well will have column of NCG (Non-Condensable Gas). This NCG mainly consists of CO2, N2, and toxic gas namely H2S (up to 10-30% of NCG Column). Thus the accumulated NCG in the well during well shut-in needs to be anticipated to ensure safety during initial production testing.

To anticipate that issue, a method is proposed namely GEO-RISE (Geothermal Gas Reinjection System for Emission Elimination) , a process of injecting NCG Accumulation into nearby well. In this paper, various aspects will be analyzed from LHD-X Well Profile and Condition, surface facilities in Cluster ABC, situation of Cluster ABC and distance to nearby community, HSSE Aspects, nearby well profile and condition which the gas will be injected into, and the pre-requisite condition to successfully implementing the method.

The method of injecting NCG accumulation from LHD-X into nearby well has been proved as a successful method and already demonstrated its effectiveness in Lahendong to abate NCG acumulation before opening the well. This method also has minimal human and environmental impact since it is a closed-system.

METHODS



The existing bleeding method, NCG including hazardous gas is channeled into a mini Atmospheric Flash Tank containing NaOH (as a reducing agent, trapping hazardous gas). There is still a possibility that the NaOH did not fully abate NCG accumulation. While in GEO-RISE method, NCG accumulation is injected into a monitoring well (which has been previously studied as a receiving well). All of NCG Accumulation including hazardous gas is injected to nearby well and is not released into the environment (a closed system).

RESULTS

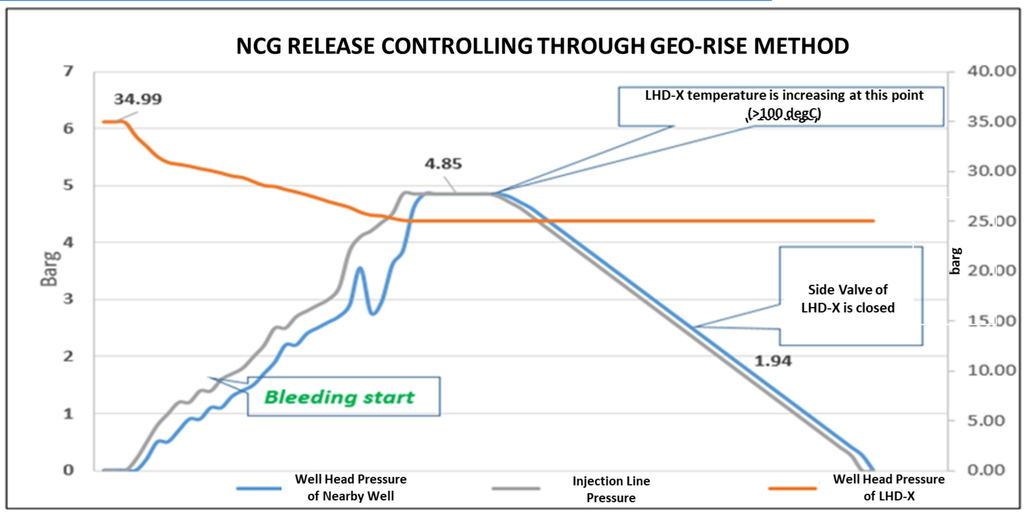
Before Geo-Rise method is implemented, to manage risks that may arise, a series of activities has been carried out as follows :

No	Top Risk	Risk Cause	Risk Mitigation
1	Facility Failure	. Poor Quality of Pipeline Integrity . Pressure and Temperature boundary of Pipeline .	. Pipeline pressure testing until certain predetermined temperature & pressure. . Make sure abatement process is still within predetermined temperature & pressure boundary.
2	Inability of Nearby Well to store NCG Accumulation	. Low Injectivity Index . Poor Quality of Well Integrity	. Conducting subsurface study of nearby well`s Injectivity Index. Nearby well must shows that it has good Injectivity Index . . Conducting Well Integrity Logging, Make sure there is no leak, obstacle, and abnormalities during logging.

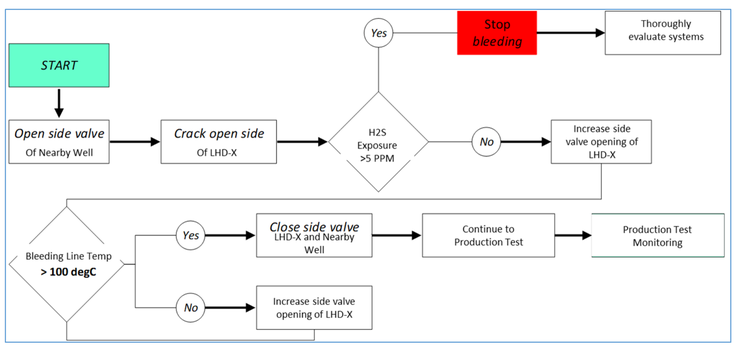
After all of risk mitigation has been carried out, the NCG release controlling through geo-rise method can be executed.

Firstly, LHD-X is opened slowly through side valve (Size 3 1/8 inch Class 3000) to abate all of NCG accumulation to nearby well. Nearby well wellhead pressure is being closely monitored. There is a strong evidence that nearby well is responding to NCG release controlling process, with the Wellhead pressure is increasing as long as injection line pressure is increasing. Until the casing head temperature of LHD-X is reaching 100 deg C and temperature of injection line is getting hotter, wellhead pressure and injection line pressure is constants or in equilibrium state.

It is the results of all of NCG accumulation already abated and now is stored in nearby well reservoir, thus all that remains in LHD-X is steam free of NCG. This method already demonstrates a closed-system method of NCG release controlling in geothermal well



DISCUSSION



In Geo-Rise method, safety aspect is mandatory. To ensure there is no leak in NCG release controlling, side valve of LHD-X is open slowly while at the same time H2S Exposure is being monitored. If there is a H2S exposure in the process, the NCG release controlling will be stopped and will be evaluated. In NCG release controlling in LHD-X, the H2S exposure is 0 ppm in every single position in the cluster. This means there is no leaking and all of the NCG accumulation is being injected in the nearby well. After increasing the opening of the side valve, the bleeding line temperature will increase until 100 deg C and production test of LHD-X well can be conducted safely.

CONCLUSION

Results shows that injecting NCG accumulation into nearby well has been proved as a successful method in Lahendong Geothermal Field to abate NCG gas accumulation before opening the well, with the given fluid chemistry, distance to nearby community, and meteorological condition in Lahendong. However more research is needed to be conducted to ensure this method can be applied to several wells and the limitation of this method can be known. By using this method, we can improve overall effiency in production testing activity while at the same time improving compliance in HSSE (Health, Safety, Security, and Environment) aspects..

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