International Journal of Scientific Research in Science, Engineering and Technology
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET2294103

Temperature and Pressure Distribution Analysis on Selected Geothermal Wells at Olkaria Using Completion and Heat Up Test Data

Kariuki Scholasticah Ngima[1], Nicholas Mariita[1], Willis Ambusso[2]
[1] Geothermal Training and Research Institute, Dedan Kimathi University of Technology, Nyeri, Kenya
scholasticahngima1000@gmail.com[1]
nicholas.mariita@dkut.ac.ke[21]
Physics Department, Kenyatta University, Nairobi, Kenya
ambusso.willis@ku.ac.ke

Article Info
Volume 9, Issue 6
Page Number : 71-80

Publication Issue :
November-December-2022

Article History
Accepted : 01 Nov 2022
Published: 05 Nov 2022

ABSTRACT

Knowledge of the true temperature and pressure at every location within the formation and their variation across the field has many applications in resource definition, delineation, and power potential and even determines how a resource is exploited. For electricity generation, the rule of thumb is a cut-out temperature of 230^0 C. Resources at lower temperatures can be used for power generation from binary plants (below 180^0C) or for direct use applications. Temperature and pressure profiles over the wellbore length, particularly those taken after injection and during heating, find use in understanding feed zones in the well and those that are unlikely to be feed zones. Discharge tests directly indicate flow rates, and data from them tend to be more reliable for simulation purposes than data from injection tests. Ultimately complete understanding of a reservoir's temperature at a location was determined after thermal recovery is considered complete. The research uses data from newly drilled adjacent wells in Olkaria 1 and systematic analysis of the database containing pressure and temperature data collected by KenGen staff during completion and heating-up tests. A conceptual model was developed from the formation temperatures and pressure based on this analysis. Temperature and pressure distributions at various depths in each well were correlated with nearby wells to provide a clear understanding of the feed zone locations. The study concluded that the formation temperatures and pressure on geothermal wells were moderate, although slightly above the expected values. The study revealed a significant effect of limited entry length on pressure and temperature behaviours. The study highlighted a strong positive association between entry length and pressure, and moderate positive association between entry length and temperature. The study revealed that injection profile pressures were the highest.

Keywords: Temperature Distribution, Pressure Distribution, Completion and Heat up Tests

I. INTRODUCTION

A. Background Information

Wells or boreholes provide essential access deep into geothermal systems that would not be otherwise possible. They are important in both geothermal information gathering and utilization and are becoming the main instruments of geothermal development. Last century there has been a significant breakthrough of increased geothermal utilization and a much-improved understanding of geothermal systems. Wells enable a vast increase in geothermal energy extraction compared to natural out-flow (Axelsson and Steingrímsson 2012).

Temperature and pressure logs are used extensively in geothermal exploration development. Their application starts when drilling commences with first exploration in a green field development and is carried out in most wells later in the development. The fundamental objective of temperature and pressure logging in a geothermal investigation is to accurately determine formation temperature and reservoir pressures. As a result of cold drilling fluid circulation, the geothermal wells and nearby formations undergo cooling. The pressure and temperature disturbances fade away gradually after drilling has ceased. After several months the wells will reach thermal equilibrium with their surroundings, and the pressure will reach equilibrium with the permeable feed zones of the well.

B. Problem Statement

Re-injection is the process of returning the geothermal fluids back into the geothermal reservoir after energy extraction (Wamalwa et al., 2016). In Geothermal power generation, re-injection is carried out for two main reasons; to slow down the rate the pressure in the system declines, and to safely dispose the extracted fluid. The process is critical for environmental considerations since surface disposal of the geothermal waste water is prohibited in Kenya (Phi et al., 2019).

Data is available in the newly drilled wells, but much has not been done to analyse and incorporate the model of the wells that were drilled earlier. Therefore, with models of the wells, it will become easier to incorporate them with the existing models as soon as they are drilled. In geothermal, the measurement of some major happenings is challenging because things are small and happen very fast. Also, it is difficult to reach the materials that are deep underground to take measurements. However, measurements from wells such as temperature and pressure can be used to construct models of the underground, which are often are critical in enabling geologists to understand what is happening or has happened. The models create basis for prediction of future happening, enhancing proper planning.

C. Research Objectives

The study aims to conduct a temperature and pressure distribution analysis on selected geothermal wells at Olkaria using completion and heat up test data.

D. Specific Research Objectives

1. To estimate the formation temperature and pressure on geothermal wells at Olkaria.
2. To develop thermal structure and temperature distribution for a geothermal resource in a section of Olkaria.
3. To find the effect of limited-entry length on pressure and temperature behaviours.
4. To investigate the effect of different injection temperatures on pressure and temperature behaviours.

II. METHODS AND MATERIAL

A. Research Method

The study used a quantitative research method. The research method entailed gathering numerical data, analyzing it using mathematical or statistical techniques, and drawing conclusions from the analysis results (Rutberg, & Bouikidis, 2018). The quantitative research method was advantageous because it enabled the researcher to gather huge datasets and on multiple variables, enhancing the generalization of results and testing of many hypotheses. Also, it was easy to apply standard statistical models to the numerical data, implying that the study yielded standard results that are comparable and replicable in the future (Ahmad, et al., 2019). Besides, the quantitative approach enabled modern statistical tools, which eased the analysis process (Rashid & Sipahi, 2021).

B. Data Description

The study used secondary data. The data was sourced from the Kengen Geology Laboratories at Olkaria's. The study gathered data from a sample of 5 wells, namely OW-35, OW-37, OW-47, OW-48, and OW-49. From each well, data was gathered for depth (m), temperature (^{0}C), and pressure (Bara) for the pre-injection profile, injection profile, and 9 hours heat-up profile. Also, data on the pump and step pumping was gathered using four variables, namely, rate (Rpm), time T, temperature, pressure, and time P. Similarly, the researcher collected data on time T, temperature, pressure, and time P for the fall-off profile. The data for the 31-day heat-up was collected using three variables: depth, temperature, and pressure.

C. Data Analysis

The study used modern statistical tools such as R and Microsoft Excel to analyse the data. The researcher majorly used Microsoft Excel for data screening and cleaning. This is because of its features such as find and replaces which helps in easy identification and correction of errors. Conversely, the R-software was used for the analysis. The R programming language has excellent statistical computing and analysis tools that support different data types. Besides, R has powerful graphics tools that allow the researcher to communicate the results accurately. Analysis procedures entailed both descriptive and inferential statistics.

The study used point estimation technique to estimate the formation temperature and pressure on geothermal wells at Olkaria. The mean was the most preferred measure of central tendency. Conversely, the study used standard deviation as the measure of dispersion. On the other hand, the study used inferential statistics to model the formation temperatures and pressure and compare temperature and pressure between wells. The study conducted a pairwise comparison of the temperature and pressure among the sampled wells using the Student's T-test procedure. The conceptual model development from the formation temperature and pressure will be done using multiple linear regression analysis techniques.

The study developed thermal structure and temperature distribution for the geothermal resource in a section of Olkaria using frequency distribution analysis. The distribution of pre-injection temperatures was presented using a frequency histogram. Similarly, the distribution of injection profile temperatures was presented using a frequency histogram. Also, the distribution of 9-hours heat-up temperatures was presented using a frequency histogram.

The study investigated the effect of limited-entry length on pressure and temperature behaviours using a linear regression analysis technique. The entry length was measured using the depth and set as the independent variables. On the other hand, the pressure and temperature were measured using the average pressures and temperatures, respectively, and set as the dependent variables. The magnitude of the association between limited-entry length and pressure or temperature was measured using the coefficient of correlation, r. Conversely, the proportions of variations in temperature and pressure explained by entry length were measured using the coefficient of multiple determinations, R-square. The goodness of fit of the regression models fitted to the data was tested using F-test obtained after conducting the model's

ANOVA. Further, the significance of the effect of limited-entry length on pressure and temperature behaviours was tested using a t-test. The decision criteria included rejecting the null hypothesis that the effects were insignificant if the p-value was less than 0.05, the set significance level (alpha).

Further, the study investigated the effect of the different injection times on temperature behaviours using one-way ANOVA. The ANOVA technique was chosen because the researcher was interested in comparing means from more than two groups. Similarly, the study investigated the effect of the different injection times on pressure behaviours using one-way ANOVA. The ANOVA technique was chosen because the researcher was interested in comparing pressure means from more than two groups.

III.RESULTS AND DISCUSSION

A. Estimating the formation temperature and pressure on geothermal wells

According to the analysis of the OW-35, the mean (and standard deviation) of the pre-injection's temperature and pressure was 115.3482 (SD=30.968) and 105.1946 (SD=63.52), respectively (Table 1). During injection, the mean (and standard deviation) of the temperatures and pressures was 51.80714 (SD=13.9431) and 114.7018(SD=72.43662), respectively. Nine hours after heating, the mean (and standard deviation) of the temperatures and pressures was 139.225 (SD=33.88399) and 105.1804 (SD=64.41421), respectively. After four days of heating, the mean (and standard deviation) of the temperatures and pressures was 139.225 (SD=33.88399) and 105.1804 (SD=64.41421), respectively.

TABLE 1
ESTIMATING THE FORMATION TEMPERATURE AND PRESSURE FOR OW-35

		Mean	SD
19.11.10	Temp	115.3482	30.96819
Pre-Injection	Press	105.1946	63.52096
19.11.10	Temp	51.80714	13.9431
Injection	Pres	114.7018	72.43662
21.11.10	Temp	139.225	33.88399
9hour heating	Pres	105.1804	64.41421
25.11.10	Temp	202.4839	53.06974
4 days heating	Pres	107.1482	56.50717
29.11.10	Temp	228.5143	54.38565
8 days heating	Pres	100.3393	51.37239

The analysis of the OW 37 revealed that the mean (and standard deviation) of the pre-injection, injection and 9 hours heat-up profile's temperatures were 104.7 (SD=63.4), 113.2 (SD=72.3), and 100.2 (SD=63.4), respectively. The injection and 9 hours heat-up profile's pressures were 47.3 (SD=29.2), and 126.0 (SD=32.0), respectively.

The analysis of OW-47 produced mean (and standard deviation) of the pre-injection, injection and 9 hours heat-up profile's temperatures as 114.6528 (SD=82.41064), 102.5083 (SD=99.074), and 134.3917 (SD=76.53773), respectively (Table 1). The pre-injection, injection and 9 hours heat-up profile's pressures were 80.08 (SD=46.43), 82.96 (SD=48.48), and 76.84 (SD=46.95), respectively.

The analysis of OW-48 produced mean (and standard deviation) of the pre-injection, injection and 9 hours heat-up profile's temperatures as 83.7 (SD=51.72216), 70.1 (SD=50.12519), and 102.7 (SD=45.10975), respectively. The pre-injection, injection and 9 hours heat-up profile's pressures were 95.8 (SD=66.93892), 109.4 (SD=71.05145), and 96.2 (SD=67.32171), respectively.

The analysis of OW-49, presented in Table 2, produced mean (and standard deviation) of the pre-injection, injection and 9 hours heat-up profile's temperatures as 146.155 (SD=69.03082), 93.3678 (SD=30.93199), and 73.06721 (SD=79.57265), respectively. The pre-injection, injection and 9 hours heat-up profile's pressures were 111.7733 (SD=77.00954), 224.9988 (SD=2.041533), and 116.4407 (SD=81.97666), respectively.

B. Developing thermal structure and temperature distribution for a geothermal resource

The distribution of pre-injection temperatures was presented using a frequency histogram, Figure 1. The histogram had a longer tail towards the right-hand side than the left-hand side, implying that the distribution was skewed positively. Therefore, a conclusion was made that a majority of the pre-injection temperatures were higher than expected.

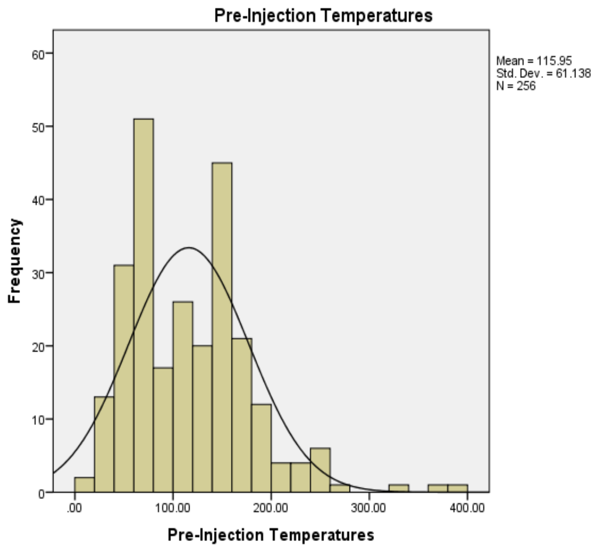

Figure 1 : The distribution of pre-injection temperatures

Similarly, the distribution of injection profile temperatures was presented using a frequency histogram, Figure 2. The histogram had a longer tail towards the right-hand side than the left-hand side, implying that the distribution was skewed positively. Therefore, a conclusion was made that a majority of the pre-injection temperatures were higher than expected. However, the peak for the injection profile temperature's distribution was very high. The high kurtosis suggested that the data had heavy tails and had outliers.

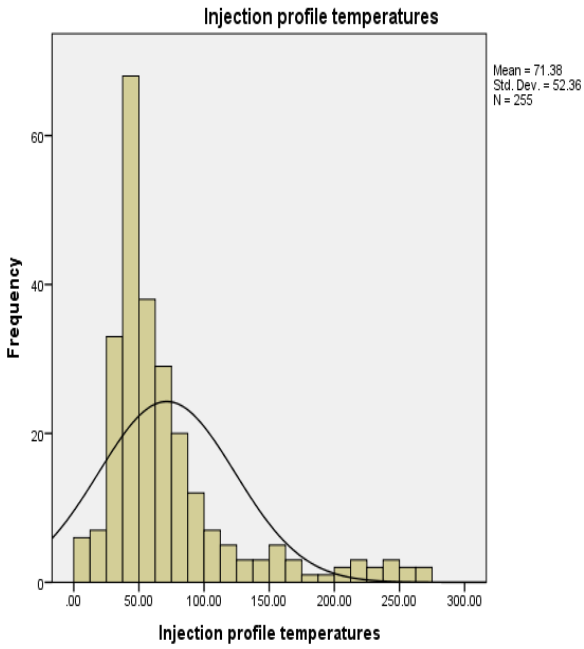

Figure 2 : The distribution of injection profile temperatures

Also, the distribution of 9-hours heat-up temperatures was presented using a frequency histogram, Figure 3. The histogram had a longer tail towards the right-hand side than the left-hand side, implying that the distribution was skewed positively. Therefore, a conclusion was made that a majority of the pre-injection temperatures were higher than expected.

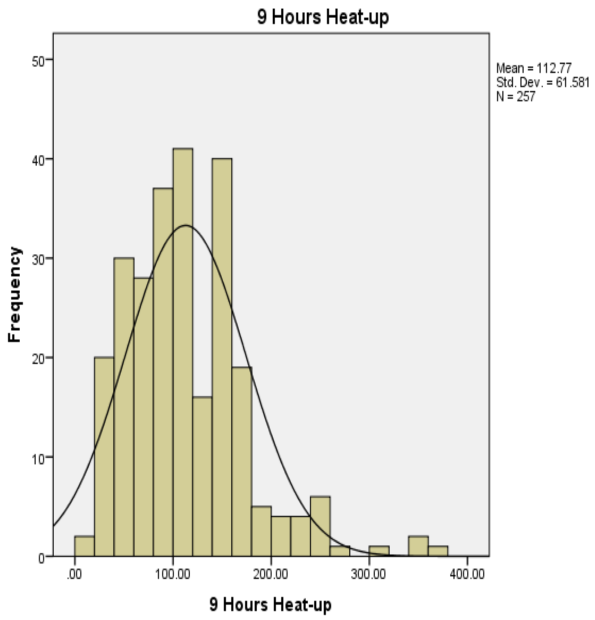

Figure 3 : The distribution of 9 hours heat-up temperatures

C. The effect of limited-entry length on pressure and temperature behaviours

The study investigated the effect of limited-entry length on pressure and temperature behaviours using a linear regression analysis technique. The entry length was measured using the depth and set as the independent variables. On the other hand, the pressure and temperature were measured using the average pressures and temperatures, respectively, and set as the dependent variables.

The effect of limited-entry length on pressure: The regression model's summary statistics for the pressure against entry length produced R and R-square values equal to 0.970 and 0.94, respectively (Table 2). The R-value represented the coefficient of correlation, and it implied that there was a strong positive association between entry length and pressure. Conversely, the R-squared value represented the coefficient of multiple determination, and it implied that entry length explained 94% of the variations in the pressure.

TABLE 2:
MODEL SUMMARY FOR THE PRESSURE AGAINST ENTRY LENGTH

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.970[a]	.940	.940	15.95689

a. Predictors: (Constant), Depth

The study tested the significance of the model using the regression ANOVA. The test produced a test statistic equal to F=4012.953, p=0.000 (Table 3). The p-value was less than 0.05, implying that the test rejected the null hypothesis of non-significance. Hence, the study concluded that the model fit was good, and that depth (as a measure of entry length) was a good predictor of pressure.

TABLE 3
ANOVA FOR THE PRESSURE AGAINST ENTRY LENGTH

Model	Sum of Squares	D f	Mean Square	F	Sig.
Regression	1021787.1	1	1021787.1	4012.95	.00
Residual	64674.1	254	254.6		
Total	1086461.2	255			

a. Dependent Variable: Pressure
b. Predictors: (Constant), Depth

The coefficient analysis results produced values equal to -16.972 and 0.075 for the intercept and depth coefficient, respectively (Table 4). Hence, the equation representing the regression model was of the form;

$$y = -16.972 + 0.075x$$

Where y was the pressure and x the entry length, as measured using the depth. The equation suggested that the pressure was expected to increase by 0.075 degrees per unit change in entry length, as measured using the depth. The significance of the effect of entry length (as measured using the depth) on temperature was tested using the t-test. The t-test results produced a statistic equal to t=63.348, p=0.000. The p-value was less than 0.05, implying that the test rejected the null hypothesis. Hence, the study concluded that entry length significantly affected the pressures.

TABLE 4:
COEFFICIENTS FOR THE PRESSURE AGAINST ENTRY LENGTH

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. E	Beta		
(Constant)	-16.97	2.263		-7.50	.000
Depth	.075	.001	.970	63.35	.000

a. Dependent Variable: Pressure

The effect of limited-entry length on temperature*:* The regression model's summary statistics for the temperature against entry length produced R and R-square values equal to 0.599 and 0.359, respectively (Table 5). The R-value represented the coefficient of correlation, and it implied that there was a moderate positive association between entry length and temperature. Conversely, the R-squared value represented the coefficient of multiple determination, and it implied that entry length explained 35.9% of the variations in the temperature.

TABLE 5
MODEL SUMMARY FOR THE TEMPERATURE AGAINST ENTRY LENGTH

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.599[a]	.359	.357	38.38404

a. Predictors: (Constant), Depth

The study tested the significance of the model using the regression ANOVA. The test produced a test statistic equal to F=142.488, p=0.000 (Table 6). The p-value was less than 0.05, implying that the test rejected the null hypothesis of non-significance. Hence, the study concluded that the model fit was good, and that depth (as a measure of entry length) was a good predictor of temperature.

TABLE 6:
ANOVA FOR THE TEMPERATURE AGAINST ENTRY LENGTH

Model		Sum of Squares	D f	Mean Square	F	Sig.
1	Regression	209932.1	1	209932.1	142.5	.000
	Residual	374227.0	254	1473.3		
	Total	584159.1	255			

a. Dependent Variable: Temperature
b. Predictors: (Constant), Depth

The coefficient analysis results produced values equal to 41.526 and 0.034 for the intercept and depth coefficient, respectively (Table 7). Hence, the equation representing the regression model was of the form;

$$y = 41.526 + 0.034x$$

Where y was the temperature and x the entry length, as measured using the depth. The equation suggested that the temperatures were expected to increase by 0.034 degrees per unit change in entry length, as measured using the depth. The significance of the effect of entry length (as measured using the depth) on temperature was tested using the t-test. The t-test results produced a statistic equal to t=11.937, p=0.000. The p-value was less than 0.05, implying that the test rejected the null hypothesis. Hence, the study concluded that entry length significantly affected the temperatures.

TABLE 7
COEFFICIENTS FOR THE TEMPERATURE AGAINST ENTRY LENGTH

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. E	Beta		
1	(Constant)	41.526	5.444		7.628	.000
	Depth	.034	.003	.599	11.937	.000

a. Dependent Variable: Temperature

D. **The effect of different injection times on pressure and temperature behaviours**

The effect of different injection times on temperature behaviours: The study investigated the effect of the different injection times on temperature behaviours using one-way ANOVA. The ANOVA technique was chosen because the researcher was interested in comparing means from more than two groups. The summary statistics, showed that the mean temperatures for pre-injection, injection profile, and 9 hours heat-up were 115.9504 (VAR=3737.872), 71.38235 (VAR=2741.52), and 112 (VAR=3792.212), respectively. The statistics revealed that pre-injection temperatures were the highest, followed by temperatures at 9 hours heat-up. The injection profile temperatures were the lowest.

The ANOVA results, presented in Table 7, produced test statistic equal to F=46.11271, p<0.001. The p-value was less than 0.05, implying that the ANOVA test rejected the null hypothesis that injection time did not affect temperature behaviours. Therefore, the study concluded that there was sufficient evidence that injection times affected temperature behaviours, with pre-injection temperatures averaging at the highest levels.

TABLE 8
ANOVA FOR THE TEMPERATURE BEHAVIORS

Source of Variation	*SS*	*Df*	*MS*	*F*	*P-value*	*F Crit*
Between Groups	315894.4	2	157947.2	46.1127	<0.001	3.007494
Within Groups	2620310	765	3425.241			
Total	2936204	767				

The effect of different injection times on pressure behaviours: Similarly, the study investigated the effect of the different injection times on pressure behaviours using one-way ANOVA. The ANOVA technique was chosen because the researcher was interested in comparing pressure means from more than two groups. The summary statistics, as presented in Table 9, showed that the mean pressures for pre-injection, injection profile, and 9 hours heat-up were 101.2092 (VAR=4340.051), 134.3529 (VAR=6111.611), and 101.0657 (VAR=4618.434), respectively. The statistics revealed that injection profile pressures were the highest. The pre-injection pressures and 9 hours heat-up pressures were almost equal.

TABLE 9
SUMMARY STATISTICS FOR PRESSURE BEHAVIORS

Groups	*Count*	*Sum*	*Average*	*Variance*
Pre-Injection Pressures	256	25909.55	101.2092	4340.051
Injection profile pressures	255	34259.98	134.3529	6111.611
9 Hours Heat-up pressures	257	25973.89	101.0657	4618.434

The ANOVA results, in Table 10, produced test statistic equal to F=18.71239, p<0.001. The p-value was less than 0.05, implying that the ANOVA test rejected the null hypothesis that injection time did not affect pressure behaviours. Therefore, the study concluded that there was sufficient evidence that injection times affected pressure behaviours, with injection profile pressures averaging at the highest levels.

TABLE 10
ANOVA

Source of Variation	*SS*	*Df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	187925.3	2	93962.7	18.71239	1.16E-08	3.007
Within Groups	3841381	765	5021.4			
Total	4029307	767				

IV.CONCLUSION AND RECOMMENDATIONS

Conclusions: The findings of the OW 35 were that 9 hours heating temperatures were the highest followed by pre-injection temperatures, and lastly the injection profile temperatures. On the contrary, the injection pressures were highest followed by pre-injection pressures and finally the 9 hours heat-up pressures. Similarly, in OWs 37, 47 and 49, the 9 hours heat-up profile pressures were highest followed by pre-injection profile pressures. The injection profile pressures were the least. In the contrary, the injection profile temperatures were the highest, followed by pre-injection profile temperatures and lastly the 9-hours heat-up profile temperatures.

The study revealed that the thermal structure and temperature for geothermal resources were almost normally distributed. The distribution of pre-injection temperatures were, however, skewed positively. Hence, the study concluded that a majority of the pre-injection temperatures were higher than expected. Similarly, the distribution of injection profile temperatures was skewed positively. The study concluded that a majority of the pre-injection temperatures were higher than expected. Also, the distribution of 9-hours heat-up temperatures was skewed positively. Therefore, a conclusion was made that a majority of the pre-injection temperatures were higher than expected.

Also, the study revealed a significant effect of limited entry length on pressure and temperature behaviours. The study highlighted a strong positive association between entry length and pressure. According to the study, the entry length explained 94% of the variations in the pressure, concluding that depth (as a measure of entry length) was a good predictor of pressure. The study suggested that the pressure was expected to increase by 0.075 degrees per unit change in entry length, as measured using the depth. The significance of the effect of entry length (as measured using the depth) on temperature was tested using the t-test. The test rejected the null hypothesis. Hence, the study concluded that entry length significantly affected the pressures.

Conversely, the study revealed a moderate positive association between entry length and temperature. According to the study, the entry length explained 35.9% of the variations in the temperature, concluding that depth (as a measure of entry length) was a fair predictor of temperature. The study suggested that the temperatures were expected to increase by 0.034 degrees per unit change in entry length, as measured using the depth. The significance of the effect of entry length (as measured using the depth) on temperature was tested using the t-test. The test rejected the null hypothesis. Hence, the study concluded that entry length significantly affected the temperatures.

Further, the study concluded that there was a significant effect of different injection times on temperature behaviours. According to the study, the mean temperatures for pre-injection, injection profile, and 9 hours heat-up were 115.9504 (VAR=3737.872), 71.38235 (VAR=2741.52), and 112 (VAR=3792.212), respectively. Hence, pre-injection temperatures were the highest, followed by temperatures at 9 hours heat-up. The injection profile temperatures were the lowest. The ANOVA test rejected the null hypothesis that injection time did not affect temperature behaviours. Therefore, the study concluded that there was sufficient evidence that injection times affected temperature behaviours, with pre-injection temperatures averaging at the highest levels.

Conversely, the mean pressures for pre-injection, injection profile, and 9 hours heat-up were 101.2092 (VAR=4340.051), 134.3529 (VAR=6111.611), and 101.0657 (VAR=4618.434), respectively. The study revealed that injection profile pressures were the highest. The pre-injection pressures and 9 hours heat-up pressures were almost equal. The ANOVA test rejected the null hypothesis that injection time did not affect pressure behaviours. Therefore, the study concluded that there was sufficient evidence that injection times affected pressure behaviours, with injection profile pressures averaging at the highest levels.

Recommendations: The study recommends that the government should invest more in geothermal energy utilization since there was evidence of sufficient energy based on the estimation of temperatures and pressures. The government of Kenya should invest on drilling more wells in Olkaria area since the area had significant potential in terms of geothermal energy.

According to the results, the distribution of the thermal structure and temperature for geothermal resources were slightly skewed to the right. That was an indication that the pressures and temperatures were higher than the expected. Hence, the study recommends alternative use of geothermal energy in Olkaria to tap the excess energy before re-injecting the water back to the ground.

The study further made recommendations for future research. The future researchers should apply multiple analysis techniques to assess the effect of limited entry length on pressure and temperature behaviours instead of univariate analysis techniques. Multivariate analysis will reveal the joint effect as well as individual effect of the various independent factors, simultaneously.

V. REFERENCES

[1] Ahmad, S., Wasim, S., Irfan, S., Gogoi, S., Srivastava, A., & Farheen, Z. (2019). Qualitative vs. Quantitative Research. *population*, *1*, 2.

[2] Phi, T., Elgaddafi, R., Al Ramadan, M., Ahmed, R., & Teodoriu, C. (2019, November). Well integrity issues: Extreme high-pressure high-temperature wells and geothermal wells a review. In *SPE Thermal Well Integrity and Design Symposium*. OnePetro.

[3] Rashid, M. H., & Sipahi, E. (2021). The importance of quantitative research in language testing and assessment: in the context of social

works. *Linguistics and Culture Review*, *5*(S1), 317-330.

[4] Rutberg, S., & Bouikidis, C. D. (2018). Focusing on the fundamentals: A simplistic differentiation between qualitative and quantitative research. *Nephrology Nursing Journal*, *45*(2), 209-213.

[5] Wamalwa, R. N., Nyamai, C. M., Ambusso, W. J., Mulwa, J., & Waswa, A. K. (2016). Structural Controls on the Geochemistry and Output of the Wells in the Olkaria Geothermal Field of the Kenyan Rift Valley. *International Journal of Geosciences*, *7*(11), 1299-1309.

Cite this article as :

Kariuki Scholasticah Ngima, Nicholas Mariita, Willis Ambuso, "Temperature And Pressure Distribution Analysis on Selected Geothermal Wells at Olkaria Using Completion and Heat Up Test Data", International Journal of Scientific Research in Science, Engineering and Technology (IJSRSET), Online ISSN : 2394-4099, Print ISSN : 2395-1990, Volume 9 Issue 6, pp. 71-80, November-December 2022. Available at doi : https://doi.org/10.32628/IJSRSET2294103
Journal URL : https://ijsrset.com/IJSRSET2294103