

Environmental geological problems caused by geothermal resources development and suggestions

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Abstract: With the development of the overall economy, the demand for renewable energy is becoming higher and higher. Geothermal resources are the resources that need to be developed most at present, but the development of geothermal resources is very difficult, and the requirements for engineering technology are also very high. This paper mainly discusses and analyzes the geological environment problems in the process of geothermal development and utilization, and puts forward how to use geothermal resources without damaging the environment.

1. Introduction

The heat energy in our earth's interior is 50000 times as much as the energy obtained by burning oil in the world, and the energy emitted from the earth's interior to the earth's surface every day has reached 2.5 times the heat energy obtained by using fossil fuels in the world. As a sustainable renewable resource, the utilization of geothermal resources can also reduce the utilization of fossil fuels and solve the problem of resource shortage. Compared with traditional natural gas, oil, coal and other resources, geothermal resources belong to a new type of energy at present. Its characteristics are renewable and clean, which can not only effectively alleviate the energy shortage in China, At the same time, it can also reduce the damage to environmental geology. However, the unscientific mining and utilization in recent years has also led to a series of environmental geological problems, which can not be ignored. At a time of increasingly environmental awareness and in order to assure energy security and offset the use of fossil fuels, the search for local sources of environmentally friendly energy is of fundamental interest ^[1]. Nowadays, people pay more and more attention to the ecological environment. Therefore, hydrogeological survey must be strengthened. The hydrogeological survey has high technical and professional requirements for the survey work, which requires that the hydrogeological survey staff should master professional survey technology and have high comprehensive quality. In addition, relevant departments should also attach great importance to hydrogeological survey, take effective management and protection measures for water resources, try to avoid serious geological disasters caused by hydrogeological problems, and give full play to the application advantages of hydrogeological survey.1. Utilization status of geothermal resources

1.1 Shallow geothermal resources

Shallow geothermal resources refer to those contained in shallow layers Thermal energy resources in rock, soil or groundwater (within 1km). In the development and utilization of geothermal energy, China has long begun to study shallow geothermal resources, and has reached the world advanced level in some fields such as power generation. In the 1970s, China successfully realized the operation of the first megawatt geothermal generator unit, which indicates that China is developing in shallow geothermal energy The application of has officially moved forward to the stage of industrialization. At present, in the utilization of shallow geothermal resources, low-temperature geothermal can be directly utilized, and high-temperature geothermal can be used for geothermal power generation. Due to the small shallow geothermal resources and narrow distribution area, it is difficult to make use of high-temperature geothermal resources, which has caused great restrictions on the development of geothermal power generation in China, and unit shutdown often occurs due to insufficient geothermal steam. When shallow geothermal exploitation

is carried out, the water level in some areas will drop significantly, resulting in serious environmental problems such as land subsidence.

1.2 Deep geothermal resources

Deep geothermal resources refer to the storage layer and exploitation depth of geothermal resources more than 1km. Although the content of shallow high-temperature geothermal resources is small, there are a large number of high-temperature geothermal resources in China's deep geothermal energy, which are widely distributed in various regions. The exploitation and utilization of these deep geothermal resources will not have a great impact on the environment. High temperature geothermal resources are widely used, and the exploitation of deep geothermal resources in China has broad development prospects. With the continuous development of science and technology and exploration technology, China has a further understanding of the distribution law of deep geothermal resources. The development of deep exploitation technology of traditional resources such as natural gas and oil has also promoted the development of deep geothermal resources exploitation technology to a certain extent, greatly improving the possibility of deep geothermal utilization. However, due to the very complex geological situation in China, there are fault depression areas in many geothermal fields and the lack of reliable geological data, which brings great difficulties to the exploration work. Moreover, due to the limitations of regional economic conditions, the exploitation of geothermal fields is more difficult. In order to offset the consumption of resources, it is very important to find local and sustainable energy. Unfortunately, subsurface data for assessing geothermal potential often do not exist. This raises a key question about how to use outcrops as deep underground analogues. In estimating the current deep temperature, the changes caused by the characterization method of laboratory thermophysical properties were further evaluated. Rock samples were collected and analyzed using a protective heat flow meter and an optical scanner to determine thermal conductivity. According to the prediction, a lower base case temperature prediction can be provided. Although there is no deep temperature measurement in the northern region, outcrop thermophysical property assessment has proved to be a useful tool for preliminary assessment of geothermal resources in remote areas facing serious energy problems^[2].

Table 1 Classification and development approaches of deep geothermal resources.

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|----------------------|--|
| Project | Deep geothermal resources |
| Classification | Heat, ore and water |
| Development approach | Geothermal well, ground source heat pump, etc |
| Purpose | Building heating, medical care, agricultural production, etc |

2. Geological environment problems arising from the development and utilization of geothermal resources

2.1 Thermal pollution of geothermal resources to climate during development

Although geothermal resources are renewable, a great part of them will be wasted in the process of development. First, during the development of geothermal resources, part of the heat is released into the atmosphere, raising the temperature of the air and leading to global warming; Second, in winter, the heating of residential buildings uses geothermal resources and water as the medium to heat the houses. Third, during the discharge of domestic hot water, some bacteria and fungi in the pipeline will also be discharged into the environment, causing pollution to the environment and threatening the human living environment.

2.2 Air pollution caused by harmful gases during the development of geothermal resources

During the development of geothermal resources, data show that in geothermal water, when the temperature of water is higher than 70 °C, high concentration hydrogen sulfide gas will be produced. This gas with rotten egg smell is toxic and does great harm to human body. When the concentration of hydrogen sulfide is too low, people will paralyze people's olfactory nerve after inhaling this low

concentration of hydrogen sulfide, Serious will cause short-term asphyxia. When the concentration of hydrogen sulfide is too high, it can directly poison people, seriously lead to death, and do great harm to human health.

2.3 Hazards of geothermal resources to land during development

In the development of geothermal resources, the main harm to the environment is the harm to the land. In the process of development, people will exploit geothermal resources and build geothermal collection stations at the location of geothermal resources, which will build some collection wells; In the process of wastewater discharge, the chemical elements in the water will corrode the land, which is the loss of land nutrients; These behaviors will cause serious damage to the land during the exploitation of geothermal resources.

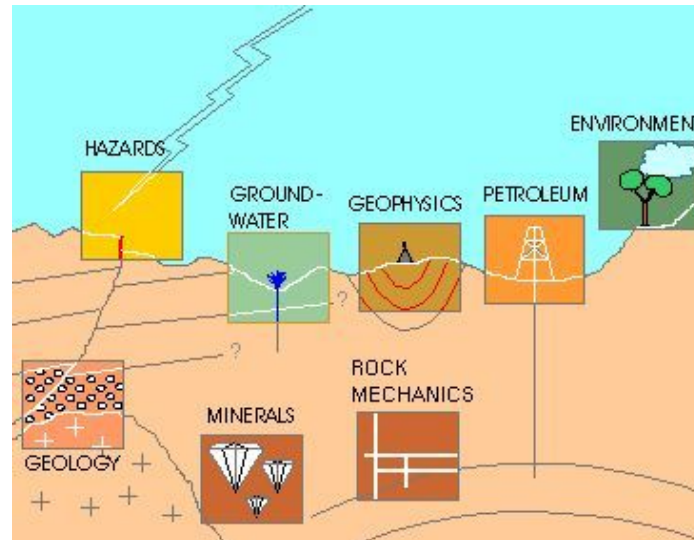


Figure 1 Geological engineering involves civil engineering and environmental conditions.

The first is the overall land subsidence and land cracks. For the development of geothermal resources, it is necessary to build wells to collect geothermal water. The construction of water intake wells will destroy the internal structure of the land and make the land structure unstable. Due to the relationship between fluid pressure and velocity, the underground geothermal water will destroy the underground water bearing rock structure. After the underground geothermal water is exploited, the interior is emptied, and the natural land will precipitate downward to fill the underground gap, which will change the various chemical properties of the land and make the upper land backlog downward. With the passage of time, the surface level will decline. With the current global warming and melting of icebergs, leading to the rise of sea level, the combined effect of the two is that the land will eventually be submerged.

The second is soil hardening and land salinization, soil hardening refers to the structural damage and soil material dispersion caused by external factors such as watering farmland or rainfall due to the lack of organic matter and nutrients and poor structure on the original soil surface. After drying, the soil surface hardens due to the cohesion of the soil and is not suitable for the growth of crops, flowers and trees. This is because the geothermal water does not meet the reasonable discharge standard in the discharge process, the concentration of metal salt ions and heavy metal ions contained in the wastewater is too high, which is not easy to be degraded in the soil, and will lead to land salinization. With the accumulation of time, the salt content in the land is higher and higher, which aggravates the salinization of the soil. Excessive saline alkali discharge leads to the destruction of the living environment of probiotics in the soil, the corrosion can not be supplemented, and the harmful substances in the land can not be degraded in time. With the passage of time, land hardening and salinization will become more and more serious.

2.4 Impact on crops

For the soil, the mineralization of geothermal mineral water resources is relatively strong. When

geothermal mineral water is infiltrated into the soil, there will be a lot of salt substances in the local soil, which will change the pH of the soil and affect the growth of crops. For example, when suddenly salinized, it will lead to a significant decline in agricultural production, and even gradually turn a piece of farmland into wasteland. At present, no organization or expert has put forward specific data on the impact of fluorine and other substances on crops, but from the overall statistical data, if an area is suddenly polluted by fluorine and other substances, the crop yield in this area will show a gradual downward trend.

3. Outlook

Although geothermal resources are renewable resources, it does great harm to the environment. Therefore, changing the current situation of the use of geothermal resources and how to use geothermal resources reasonably without damaging the environment are the primary consideration in China. In the process of using geothermal resources, the most important problem to be solved is the problem of geothermal wastewater. The rational use of geothermal resources is directly related to the address problem, so it is necessary to solve these problems, adhere to the principle of sustainable development, and protect the ecological environment while using geothermal resources.

4. Conclusion

Geothermal resources are widely used, and people depend on geothermal resources. In the process of developing geothermal resources, there are not only many technical problems, but also unreasonable pollutant treatment methods have greatly damaged the atmospheric environment and water environment, and affected the normal growth of crops, animals and plants. Electricity generated from possible geothermal reserves. There are many similar reserves for thermal production. Through tough2 thermal hydrodynamics mining simulation of the determined productive geothermal reservoir, it is predicted that the power output may increase, so that the central heating system can provide enough heat ^[3]. In view of this situation, China's relevant personnel and departments should pay enough attention, increase the research on green technology and pollutant treatment technology for the development and utilization of geothermal resources, minimize environmental geological pollution and maintain the natural ecological balance.

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