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Heat stress management for workers in hot climates

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Statement of the Problem: Heat stress illnesses and deaths are still occurring in the oil/gas/mining sectors worldwide. Companies have a duty of care to their workforce to ensure controls are in place to reduce risks/hazards in the work place.

Methodology & Theoretical Orientation: Heat stress management plans are set up in many industries like construction/mining/oil and gas/maritime etc., in Australia, Papua New Guinea and also in the Danakil desert in Ethiopia. These plans are country/project specific to meet the needs of employees working in these austere environments.

Findings: On every project that we have rolled out these heat stress management plans, we have been able to reduce all heat stress related illnesses to nil. We also found that we can reduce fatigue conditions thereby reducing accident/incidents from occurring and also decrease minor sprains and strains, thereby decreasing MTI's/LTI's. The plan also reduces down time such as work rest cycling via the use of the thermal work limit heat stress indices and engineering controls that we can introduce, this is a win-win situation for any company and its employees, as it reduces lost production costs to the company and also reduces the chance of an employee having a heat stress illness event and also increases productivity of the worker because the comfort ability rating to the body is much higher, which means they will be able to burn off more energy with a reduced risk of heat stress illness.

Conclusion & Significance: Heat stress management plans are easy to set up and cost effective, they can if instigated effectively reduce heat stress illness to nil and reduce fatigue and workplace incidents.

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Wellbore stability analysis model including poro-elastic, chemical and thermal effect during underbalanced drilling operation for fractured reservoir

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Before drilling operation, rock stress is described by the *in situ* stress, which includes effective overburden stress, effective maximum horizontal stress and effective horizontal stress. As the drilling continues and the hole has been drilled the support provided by the rock will be removed as a result of the drilling operation and supposed to be replaced by the hydrostatic pressure. The statues of the rock surrounding the wellbore will be alter which will redistribute the in situ stress around the wellbore due to the excavation, causing mechanical wellbore stability problems such as hole enlargement, hole reduction, lost circulation and may leads to serious well control problems specially in fractured reservoirs. Therefore preventive measurement should be taken in order to planning stable wellbore and identification of stability problems in the field. In addition, to evaluate the potential for wellbore stability a realistic model is recommended to be used to calculate the stresses and strains around the borehole. Therefore, this paper presents an approach to simulate the wellbore stability under chemo-thermo-poro-elastic conditions. This approach incorporates finite element modeling technique and effective permeability tensor for small to medium generated fractures (length <20 m). The simulation of wellbore stability process is running in underbalance drilling (UBD) technique conditions. This is to prevent formation damage, avoid lost circulation and increase rate of penetration. Where, UBD is also dangerous and may lead to wellbore failure due to absence of positive support created by the hydrostatic of the drilling fluid column. Hence, the application of UBD should be assessed throughout the use of *in situ* stresses and rock mechanical properties to estimate under which hydraulic drilling conditions in the wellbore is stable. Analytical solutions for stress distribution for isotropic and anisotropic rocks are presented. In addition, a solution for the upper limit for the mud window to prevent tensile failure is developed.

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