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| **«agreed»** | **«approved»**  **Operations Director** |
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**Emergency response plan**

**In case of blowouts and oil and gas shows**

**During drilling operations of \_\_\_\_ Company**

**General provisions**

The emergency response plan has been developed based on Policies and Procedures of \_\_\_\_\_\_\_, «Instruction on planning of accidents elimination» and Safety Rules in oil-and-gas producing industry of the Republic of \_\_\_\_\_\_\_.

The Plan will envisage all necessary preventive measures, list all potential contingency situations that may arise during wells drilling and testing, and develop the practical contingency plan for personnel for elimination of possible accidents. The contingency plan is developed with the purpose to diminish risk to people, equipment and environment in conduct of the operations, localization and recovery of contingency situation. For efficient realization of this Plan a team play and joint efforts of employees on the drill site are required – **everyone** should know his responsibilities in conduct of operations in normal conditions and in implementation of emergency measures. The Procedures, described in this Emergency Response Plan are to be used solely as a general guideline, but not replace the measures and actions that could be dictated by common sense and sober assessment of a situation.

1. **Requirements for preparation for drilling-in the production horizon** 
   1. The well design and BOP equipment, installed during sealing of wellhead, shall be dependable and provide for safety of well kill operations, including instances when complete replacement of drilling fluid in well by formation fluid is required.
   2. During drilling operations the efficiency and safety of works under gas and oil shows hazard are mostly dependent on level of practical training of the operational crew. After the BOP equipment has been installed on a wellhead, regular trainings shall be conducted with every shift crew on practical actions in case of blowout until the crew acquires sufficient qualification in recognition of blowout signs and in well control.
   3. Before commencement of drilling-in into a production horizon, a complete set of casing tubes with gaslight connections and casing accessories shall be available on site.
   4. Drilling-in into the production horizon and further well deepening shall be conducted strictly in accordance with the approved "Plan of works for drilling-in into the production horizon", requirements of the "Instruction on prevention of open blowout in construction, operation and workover of oil and gas wells" and the accepted drilling technology. The special attention shall be paid to the requirements of provision of blowout safety.
2. **Drilling-in and further drilling of producing horizon** 
   1. The drilling-in into production horizon and further drilling in the producing horizon shall be conducted under the supervision of Company specialists.
   2. During the drilling-in and further drilling in the production horizon, loss of circulation is possible. Before commencement of works it is necessary to check the stock of loss circulation material (LCM), its parameters and required stock of water.
   3. In case uncontrolled loss of circulation occurs or depletion of drilling fluid and water stock, well deepening operations shall be suspended and plan of further operations revised.
   4. The responsible engineering personnel shall make records no less than once per shift in the register on works conducted on the drill site, on equipment and degassers operation tests, register all abnormities in the process of hole making and measures, taken for elimination of such.
   5. Drilling-in to production horizon shall be conducted with use of the drilling mud, providing for back pressure of 4 – 7%, but no more than 2,0МPа.
   6. Gas logging service shall monitor drilling operations on round the clock basis, including determination of overall volume of gas, content of hydrogen sulfide (H2S), elution analysis of gas, rate of penetration and control the level of drilling mud.
   7. In case gas content in drilling mud is higher than 1,0%, mud shall be degassed. If gas content increases up to 2,0%, drilling operations shall be suspended with the purpose to establish the causes of saturation of mud with gas. If during circulating gas content remains on the level higher than 2.0%, mud density in the hole should be increased gradually with the aim to increase bottomhole pressure and drop off gas content in drilling mud up to the normal level.
3. **Blowout prevention measures** 
   1. Keep in working condition the means of early determination of blowout situation.
   2. Avoid long term shutdown of well with opened production horizon without periodical circulating of well at bottom hole.
   3. Periodically check the circulating fluids characteristics, such characteristics shall provide for back pressure on required level in well with opened production horizon during drilling and round trip.
   4. Constant control over the level of circulating fluid during drilling and circulating operations on well. If during the drilling a level gauge alarm actuates, pull up kelly above the rotary table and switch off drilling pumps immediately, determine flow of flush liquid from the well by the mud channels. If there is no mud flow, accurately determine the cause of alarm actuation and make sure there is no oil inflow.
   5. In case pressure on drilling pumps drops off, make sure the pumps work in predetermined standard conditions. If there are no changes in pumping conditions, stop the pumps and determine if there is flow of flushing liquid from the well. Absence of flow may indicate the necessity to circulate the pipes.
   6. In case drilling speed rapidly increases in the process of drilling, well deepening shall be stopped, kelly pulled with pumps on, up above rotary table, in such position that flat part of kelly is located above the BOP rams, and circulate the bottomhole zone. When circulating, control the level of returning fluid in receiving tank and in case of level raising, close preventor. After sealing of wellhead and determination of pressure, conduct calculations and start killing of well by one of the methods chosen.
   7. When pooling up drilling instrument, a Trip Tank must be used, calculate and control matching of drill pipe stand number with volume of fluid added. In case it becomes clear that actual volume of fluid added is less than calculated volume, suspend pulling up and make sure calculations were correct. In case of oil or gas shows, the drilling fluid flow will be seen in mud channels when the well is filled. In such a case, seal the well and start elimination of oil and gas shows.
   8. During run-in of drilling instrument, the conformity of the quantity of drill pipes run-in to the amount of drilling fluid discharged should be checked periodically after the agreed number of drill pipe run-in. In case the volumetric gain of liquid in the Trip Tank is in excess of calculated, stop run-in and monitor flow of flushing liquid from the well. The lesser volumetric gain of circulating liquid indicates fluid losses. If such is a case, it is necessary to decrease the speed of drilling tool running-in, circulate the hole, and if required, treat drilling fluid. In both cases further works shall be conducted under the more strict control over the well condition.
4. **Well casing** 
   1. Casing of well shall be conducted in accordance with the approved plan of works for every well, and such plan shall appoint the persons responsible for conduct of every separate operation and for the plan in whole.
   2. During the well casing operations, oil and gas shows may occur during casing run-in or during pumping and hardening of cement. The over-speeding of casing can cause hydraulic fracturing of formation and loss of drilling fluid with further gas or oil blowout.
   3. Quality cement with correct well design chosen and cement-slurry composition preclude behind-the-casing flows, cement degradation under the influence of aggressive components of formation fluid, formation of springs and flow through annular space during hardening of cement.
5. **Well development** 
   1. Risk of gas and oil shows during flow test, stimulation and development of well is possible during perforation works, running or pulling of tubing string and packers, as well as during long-term shut-down of well with open production horizon, without circulating out on the bottom hole.
   2. Preparation of well to run packer and running of packer shall be conducted at a presence of the representative of well completion service company, basing on work plan, approved by the company management and agreed with \_\_\_\_\_\_\_.
   3. Leak-off testing of production tree, of well hookup bends and joints shall be conducted at a presence of the representative of \_\_\_\_\_\_\_. The respective act shall be executed on the results of such testing.
   4. Well development works shall be conducted based on the approved plan, developed by the geological and technical services of the Company and agreed by \_\_\_\_\_\_\_.
   5. The Act on well readiness for flow stimulation operations shall be executed. A permit for well development is to be obtained from the representative of \_\_\_\_\_\_\_.
   6. Well development is to be conducted in accordance with the technology, envisaged in work plan.

**Work Safety requirements during drilling of wells on the fields with high content of hydrogen sulphide**

1. Assembly of drilling equipment shall be done considering wind direction so the worksite of drill rig could be better ventilated. Where necessary, considering the terrain relief, artificial ventilation shall be envisaged.
2. The wind direction indicators shall be installed in position that they are within the eyeshot from any point of site and from the rig floor.
3. Mud degassing equipment should be installed in such a way that gas from the well could be withdrawn to the safe distance and burnt in case signs of hydrogen sulphide were detected.
4. Before commencement of works on opening of production horizon, a Safe Instructing Point (SIP) must be in place for evacuation of personnel in case of H2S emission hazard. SIP is to be located at the distance minimum 80 meters, at the windward side from the well and on the level equal or higher of well elevation point. A container with certain quantity of 30-minutes self-contained breathing apparatuses and 10-minutes breathing apparatuses for escape shall be stored on the SIP.
5. The drilling crew, servicing personnel of \_\_\_\_\_\_\_ Company and other service companies, whose presence on the drill site is necessary, shall be provided with breathing apparatuses for protection from H2S exposure.
6. Before opening of production horizon with H2S content, the drilling crew has to pass the additional instructions on safety measures in case of hydrogen sulphide detection. All members of drilling crew should be aware of hazardous effect on human body, first symptoms of poisoning, first pre-doctor aid and know how to use breathing apparatuses and H2S monitoring systems (gas analyzers, detectors, dosimeters). All personnel should know the place of storage of breathing apparatuses and, if necessary, know how to use H2S monitoring equipment.
7. Oxygen resuscitator should be stored in the place easy to access, isolated from dust and humid, possibly in the office of drilling supervisor or other office on the work site. Personnel should be instructed on use of resuscitator.
8. Four-channel H2S monitor shall be installed and maintained in working condition for control over content of H2S in the ambient air with visual and audio alarm signals. The remote sensors shall be installed on the bell nipple of BOP, on screen shaker, wellhead cellar and drill site. On the drilling site several H2S and flammable gas detectors shall be stored in working order for use when necessary. The results of measurements shall be registered in the log of monitoring of ambient air (in the form attached to the work plan).
9. In case hydrogen sulphide detected in the ambient air of work zone in the concentration above the maximum permissible level (10 ppm), the first immediate actions are:
   * Put on breathing apparatus;
   * Notify works supervisor and people in the hazardous zone;
   * Take first priority measures for elimination of gas content;
   * Employees, not involved in the first priority actions shall escape from the hazardous zone and gather at the Safe Instruction Point (SIP);
   * Delineate the hazardous area with safety signs (considering the wind direction);
10. The drills in case of blowout should be conducted as often as necessary until main personnel and personnel of servicing companies become aware of their responsibilities and correct procedure of well shut-in. As soon as personnel obtain the necessary training, drills shall be conducted weekly with every shift.
11. The sufficient stock of Ironite Sponge or any other H2S inhibitor shall be stored at site, as well as a sufficient stock of caustic soda in case of drilling mud contamination with oxygen sulphide gas.
12. No welding works may be conducted until the ambient air is thoroughly inspected with special inspecting devices for determination of explosive concentrations of gases in the air. Flash point of H2S is low – 5000 Fahrenheit (2600С) and it becomes explosive if mixes with air in the concentration from 4,3 to 46,0 percent.

**Neutralization of flushing fluid with H2S content**

1. No less than two sets of Garrett gas trains shall be kept on the drilling site in working condition for detection of presence and concentration of dissolute sulphides in drilling fluid filtrate.
2. After drilling out of the protecting string shoe, measure sulphides content regularly, at least every 24 hours with Garrett gas train.
3. Ironite Sponge is the most preferable chemical to be used for neutralization of drilling fluid from H2S, but also the basic zink carbonate may be used or the other alternative inhibitor. H2S inhibitor shall not be added to the system until the content of hydrogen sulphide is determined.
4. After H2S was detected in drilling fluid, the daily additive dozes of H2S inhibitor shall be determined by the respective measures.
5. Factor pH in drilling fluid should be maintained on the level higher than 10.5, preferably from 11.0 to 11.5. This high level of pH should be maintained from the moment well was deepened below shoe of protection string. Rapid decrease of pH is a sign of hydrogen sulphide influx into the mud system. Caustic soda neutralizes sulphide ions, but does not release them out from the fluid. In case treatment with soda is suspended, or if any additional H2S influx has place, pH factor shall decrease and reverse reaction will start on release of sulphide ions and hydrogen sulphide gas.
6. Before drilling-in to the formation with hydrogen sulphide content, it is recommended:
   * Increase pH factor up to 11.0-11.5;
   * Conduct preliminary treatment of the active system with Ironite Sponge (up to 6,8 pond/barrel) or zinc carbonate.
   * For protection of tubing from H2S corrosion, film-forming amine shall be added into the mud. It is important that tubing string is to be covered with inhibitor before signs of oxygen sulphide gas. Amine inhibitor concentration should be within the range of 0,4-0,5 pound/barrel. Concentration higher than 1,0 pound/barrel may lead to aeration of mud and reduction of activity of Ironite Sponge.
   * Zinc carbonate is used for the uptake of residual sulphide ions, remaining in the mud even with increased pH. Zinc carbonate strongly impacts the mud rheology, and measurement of mud parameters shall be conducted more often.

**Substantive provisions of the Emergency response plan:**

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| **№№** | **Possible emergency situation** | **Rescue of people and emergency response actions** | **Responsible persons** | **Persons to be notified on the emergency situation** |
| 1 | Flushing liquid loss while drilling in open production horizon with no gas shows. | 1. One who noted the decrease of level or full loss of circulation shall immediately inform the drilling supervisor. | First crew member who noticed | Drilling supervisor,  Drilling manager |
| 1. Stop drilling and pick up the instrument, continue filling in safe zone (if possible, to the drill string shoe). | Drilling supervisor,  Driller |
| 1. Determine the cause and character of loss, start preparation of mud adding the necessary loss circulation material. Fill the well with mud periodically. | Drilling supervisor and drilling crew members. Supervisor,  Drilling engineer |
| 1. Eliminate loss by adding to the well the mud with additives, reduce drilling mud weight up to minimum allowable. | Supervisor,  Drilling engineer |
| 1. In case oil and gas shows detected, close upper preventor and organize monitoring over the well. |  |
| 1. After sealing of the well and determination of excess pressure, make calculations and start well killing. |  |
| 2 | Gas show during drilling. Mud – of low weight and high density, smell of hydrogen sulphide. | 1. First one who noted should inform immediately the driller and drilling supervisor | First who noted | Drilling Supervisor,  Drilling Manager |
| 1. Stop drilling and if no overflow from the well, pull up instrument to the risk-free zone with pumps stopped. Restore circulation. | Drilling supervisor, Drilling Engineer. |
| 1. Establish round the clock monitoring over the well. Monitor the drilling mud characteristics, presence and content of solute sulphide in the drilling mud filtrate. If hydrogen sulphide was detected in the drilling mud, treat the mud with caustic soda for maintenance of pH on 11,0-11,5, and add H2S inhibitor into the system. | Drilling Engineer, Mud Engineer,  Drilling Supervisor |
| 1. Maintain control over H2S content in the ambient air. Put on the results of measurements in the environment monitoring log. | Drilling Supervisor and Drilling engineer, drilling foreman |
| 1. Take the necessary measure to enhance gas-fire safety during conduct of works. The workers of drilling crew shall be located at the windward side from the well and have breathing apparatuses. |  |
| 1. Conduct mud degassing. If mud weight does not restore after degassing, remove gas saturated packs of mud from the system into the spare tanks or earthen pit. | Supervisor |
| 1. Flush out until complete improvement of drilling mud characteristics. |  |
| 1. In case gas shows grow, close the upper preventor. After wellhead sealed and excess pressure determined, make calculations and start well killing by one of the method chosen. |  |
| 3 | Strong gas shows during drilling. Shows of mud packs strongly saturated with gas, with low weight, strong smell of sulphide hydrogen, overflow and splash out of flushing liquid when pumps are stopped. | 1. The one who noted should immediately inform the driller, drilling foreman, and all the crew members. | First who noted | Drilling supervisor,  Drilling Manager |
| 1. Push up the instrument and switch off the pumps. Close universal preventor and close the valve, shutting down choke manifold from BOP manifold. | Drilling foreman,  Drilling crew members, drilling engineer. |
| 1. Control tubular and annulus pressure changes. After pressure determined, make calculations and start well killing by one of the methods chosen, under the supervision of drilling supervisor and at the presence of \_\_\_\_\_\_\_ representative. | Drilling supervisor,  Drilling engineer, drilling foreman,  Mud engineer |
| 1. While well killing constantly degas the drilling mud returning from the well and measure its characteristics. Control over presence and content of solute sulphide in mud filtrate. |  |
| 1. With the purpose to avoid sticking of instrument, periodically reciprocate drill string through universal preventor. During this operation annulus pressure shall not exceed 6,0 MPa (60kg/cm2). |  |
| 1. In conduct of oil-and-gas elimination works, not allow increase of excess pressure on wellhead more than 80% of casing pressure test pressure. |  |
| 1. Drilling crew members shall have the breathing apparatuses. |  |
| 1. Constantly monitor the content of H2S in ambient air. In case hydrogen sulphide was detected in the air of working area above maximum allowable concentration (10mg/m3), one should put on breathing apparatus immediately. Persons, not involved in first priority actions, shall leave the hazardous area and gather on the gathering point. |  |
| 1. In case oxygen volume content in ambient air is less than 16% and volume content of hazardous components is higher than 0,5%, respirators can not be used. The works may be conducted only with oxygen breathing apparatus. |  |
| 1. Take measures to increase gas-fire safety. The explosivity limits of methane are 5-15% of volumetric content in air, hydrogen sulphide - 4,3-45,5% of volume content in air. In their work, drilling crew workers shall be governed by «The Instruction on first priority actions of drilling crew members, testing and workover crew members in gas-oil-water shows» and shall be located on windward side from the blowout source. |  |
| 4 | Oil-gas shows with drilling instrument stuck in well and Kelly stem (Kelly does not allow to close the ram BOP) | 1. Call the drilling supervisor to the drill site. 2. Strain the drill string up to own weight and break out at the depth as more as possible. 3. Pull up the Kelly and close rams of tube and upper preventor, make sure that valves on slots are opened, but the end ram is closed. 4. In case actions 2 and 3 are impossible, seal the wellhead with bag type preventor on Kelly stem. 5. After sealing of wellhead determine excess pressure in tubing and annulus and measure increase of drilling mud volume in receiving tanks. Make calculations and start well killing operations. 6. Well killing shall be conducted with drilling mud of corresponding quality, with respective characteristics, and the mud going out of well shall be passed through vacuum degasifiers. If after degasifier mud weight is not recovered, it should be pumped out from circulation system to the spare tanks. Control the presence and quantity of solute sulphides in mud filtrate, if necessary, treat the mud by H2S inhibitors. 7. All members of the drilling crew should have insulating breathing apparatuses. 8. Conduct constant control over ambient air, and particularly, content of H2S. In case hydrogen sulphide detected in concentrations above the maximum permissible value, all should immediately put on the insulating breathing apparatuses. Persons, not involved in the operations, shall leave the hazardous area and gather at the gathering point. 9. After completion of well killing works and return of well into normal condition, continue retrieving of remaining tubing according to the approved plan. In case the results of well killing operations were negative, further works shall be conducted according to the newly approved plan. | Drilling foreman, drilling crew members | Drilling supervisor and Drilling Manager |
| 5 | Oil and gas shows during pulling-and-running operations, splash-out of drilling mud. | 1. Inform the drilling foreman about the situation, drilling foreman shall notify everyone on site by audio signal about emergency situation. 2. Stop pulling or running of drilling instrument, immediately assemble trunnion ball valve on it with Kelly or emergency flushing valve. Seal the well head by closing upper preventor rams in the sequence, envisaged by the Instruction on first priority actions of drilling crew members during pulling-and-running operations. 3. After sealing of well, determine wellhead pressure in tubular and annulus space, measure increase of drilling mud volume in receiving tanks. Basing on these data, make calculations and start well killing according to the method chosen. 4. The necessary safety measures, actions of personnel and sequence of operations shall be as described in clause 4. | Drilling foreman, drilling crew members | Drilling supervisor,  Drilling manager |
| 6 | Oil and gas shows with no drilling string in the wellbore | 1. Inform all the personnel on emergency situation by audio signal. 2. Immediately run in stand of pipes or one joint with back valve or ball valve, if the situation allows, run several stands of pipes. Adjust tool joint so that the lower collar is below the lower preventor rams. Close the lower ram preventor. Wellhead sealing operations shall be conducted in the sequence envisaged in the Instruction on first priority actions of the drilling crew members during oil-and-gas shows with no drilling string in the wellbore. 3. After wellbore was sealed, determine wellhead pressure. Measure increase of drilling mud in receiving tanks. Basing on these data, make calculations and start well killing operations. After wellhead sealing and during well killing operations, strictly avoid increase of pressure in casing higher than 80% of pressure test pressure. 4. All members of drilling crew, working in the hazardous area shall have oxygen breathing apparatuses. In case H2S content in ambient air was detected higher than admissible concentration limit, everyone should immediately put on breathing apparatuses. Personnel, not involved in operation shall leave the hazardous area and gather at the gathering point. 5. If in oil and gas show it is impossible to run the drilling instrument into well, the wellhead shall be sealed by closing preventor with blind rams. Further works shall be conducted in the same sequence as described above. | All Crew members, drillman  Drilling foreman, engineering technician responsible | Drilling supervisor,  Drilling Manager |
| 7 | Oil-gas blowout if preventor is absent or it is impossible to close preventor | 1. Immediately inform all crew members and drilling foreman on site about the emergency situation. 2. Stop all works in gassy area and evacuate people immediately. All those located in gassy area shall have breathing apparatuses. 3. Stop the internal-combustion engines, switch off field lines and lighting lines, that may be in gassy areas, stop fuel feeding. In rapid gas pollution of the area around the well, electric power shall be switched off from beyond the hazardous (gassy) area. 4. Stop all hot works, smoking, use of steel instrument and other works/actions that may cause spark formation on the territory that may be contaminated with gas. Take the necessary efforts to organize shut down all the neighboring production facilities (transformer pillars, conventional pumping units, gas distributing points and etc.), that may be in gassy area. 5. Control the condition of ambient air. Mark the closed boundary of gassy area with warning pennons and warning signs: «Gas-polluted area. Passage or entry prohibited», «Gas hazard» and etc. Prohibit smoking, fire making, use of spark forming instrument, evacuate automobile transport and tractors. 6. Deliver predoctor medical care to injured and evacuate them from the gas contaminated area. 7. Take measures to prevent oil spill and contamination of environment. 8. Prohibit any movement on the territory adjacent to the blowing well. Organize watch posts on the territory adjacent to the drill site and on the access roads, block passage and access. | Supervisor, drilling foreman, crew members | Management of \_\_\_\_\_\_\_ Company, \_\_\_\_\_\_\_,  Representatives of "Sanoatkonhechnazorat" |
| 1. Inform \_\_\_\_\_\_\_ management on initial measures taken. Call the \_\_\_\_\_ of blowout and gas safety, fire-fighting service and emergency ambulance. Further works shall be conducted under the supervision and management of emergency operations headquarters. | Supervisor |

**«Approved»**

**Operations Director, \_\_\_\_\_\_\_**

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**LIST**

**Of persons and authorities to be notified about the emergency**

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**Ambient air control log (hydrogen sulphide content)**

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| №  Of probe | Date and time of sample taking | Place of sample taking  Well No, field | Hydrogen sulphide content, mg/m3 | The analysis conducted by: NAME | Reason of high gas content | Measures to eliminate the reasons of high gas content |
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