Ensuring The Safety Of Onsite Personnel And Neighboring Community During Workover And Well-testing Activities With A High H₂S Risk Potential - A Case Study
Andrea Ferrante, Elie Daher, United Safety, Hugh Warwick, OMV Petrom

Abstract
OMV Petrom had a planned workover and well-testing activity on a well with high potential concentration of hydrogen sulfide (H₂S) located 200 meters from a neighboring community. To ensure safety during the workover and well-testing activity, a leading oil and gas group in Central Europe undertook a careful preparation of processes, systems and its personnel. Considering the proximity of the wellsite to the community, they also needed to inform and educate the surrounding community.

Servizi Integrati di Sicurezza (S.I.S. S.r.l.), part of United Safety International Group was given the task to ensure the safety of personnel and neighboring community through effective preventive actions including extensive H₂S training and prevailing wind monitoring. A site-specific Emergency Response Plan (ERP) was developed that defined the coverage of the Emergency Planning Zone (EPZ). Wind speed and direction was monitored for a period of four months prior to the drilling activity which allowed the identification of high risks areas in the event of a gas release.

A dedicated wireless H₂S and sulfur dioxide (SO₂) gas detection system was installed including a general alarm system for public awareness in case of a public evacuation. Rovers were dispatched continuously to monitor remote areas of the EPZ. The safety solutions company conducted H₂S drills, man down simulations, and public evacuations in coordination with the operator and the local community. Prior to commencement of drilling activities, nearly 400 training certificates were released to personnel, contractors and sub-contractors.

This paper discusses lessons learned and best practices of emergency planning and management of the EPZ as critical elements of drilling operations. It highlights the continuous improvement of EPZ management methods and discusses the importance of engaging affected communities and residents to build confidence, partnerships and ultimately boost a company’s public image. The paper also demonstrates the impact of corporate citizenship and responsible care practices beyond the immediate community.

Introduction
Romania has the largest refining capacities in Eastern Europe. It has nine crude oil refineries with a total capacity of 467,642 barrels per day (bbl/d). Oil production has declined over the years due to lack of investments. However, its refinery output exceeds domestic consumption. This allows the country to export surplus petroleum products including lubricants, bitumen and fertilizers.

Prior to 1995, the former national oil company Rompetrol S.A. granted production sharing agreements (PSAs). After the fall of the communist regime, the first oil law was passed. Since then, Oil and Gas exploration and production operations in Romania are based on concessions granted by the state for a maximum three-year period.
Key legislation in Romania includes the Oil Law of 2004, the Electricity and Natural Gas Law of 2012, and the Gas Law of 2004. The National Agency for Mineral Resources (NAMR) and the Romanian Energy Regulatory Authority (ANRE) issues the methodological norms for the Application of the Oil Law including technical instructions, procedures, methodologies and orders.

In 2004, Petrom was privatized by the Romanian state. The Austrian oil company OMV bought Petrom effectively making OMV Petrom the largest oil and gas producer in Eastern Europe with onshore production accounting for 80% of its oil and gas production.

Since its departure from the communist regime and the succeeding privatization, the company has been developing safe work practices in upstream operations as per international standards. A recent project experience for the 20 Adjud exploration well is a demonstration of the company’s commitment to instill operational safety across all aspects of its Oil and Gas exploration and production activities.

The 20 Adjud Exploration well was found to have a potential lethal amount of hydrogen sulfide ($H_2S$) and carbon dioxide ($CO_2$) concentration in April 2011. Prior to this, there was minimal indication of $H_2S$ in the 20 Adjud exploration well during re-entry, well servicing (completion operations) and well test operations. However, the maximum amount of 8% $H_2S$ and 24% $CO_2$ were found during testing.

While none of the offset wells indicated $H_2S$ in the area, after acidizing the lower formation (Dogger) and starting to flow back, these quantities of $H_2S$ and $CO_2$ were measured. Since these percentages were lethal, the operator decided immediately to abandon the well, isolate the lower formation to test and stimulate the upper two zones at a later time.

The 20 Adjud well is situated 250 meters away from Lespezi village with approximately 4,500 inhabitants. The operator took all the necessary materials and equipment for a sour gas well test operation. In January 2012, the well was suspended. Regular monitoring was done to ensure no pressure build up either in the annulus or the tubing.

The operator addressed the immediate risk of Sulphide Stress Cracking (SSC). When exposed to an environment containing $H_2S$, many materials may become brittle and fail, as a result, of SSC. In accordance with the National Association of Corrosion Engineers (NACE) International’s Standard MR0175 approved selection of equipment and materials, the operator immediately installed SSC-resilient barriers to protect workers and the communities.

However, a failure or release of gas containing up to 8% $H_2S$ could have severe consequences. $H_2S$ is a highly toxic gas. It is colorless and slightly heavier than air thus communities in low-lying areas or areas situated downwind were at high risk.

**Statement of Theory and Definitions**

The Oil and Gas industry has imposed strict regulations for activities involving hydrogen sulphide and sulfur dioxide. Several international and local regulations and recommended practices were reviewed and taken into consideration to keep this workover and well-testing activity safe.

$H_2S$ has an odor of rotten eggs. Even at relatively low concentrations of $H_2S$, a person can rapidly become incapacitated without warning. Death may follow in minutes. At higher concentrations, however, the odor is not noticeable due to the rapid paralysis of the sense of smell.

The Occupational Safety and Health Administration (OSHA) established 20 ppm by volume as an acceptable ceiling concentration (ACC) for $H_2S$, and 50 ppm (10-min maximum peak) by volume as an acceptable maximum peak above the ACC for an 8-hour shift. Meanwhile, the American Conference of Governmental Industrial Hygienists (ACGIH) recommends a Threshold Limit Value (TLV) of 10ppm (8-hour TWA) and short-term exposure limit (STEL) of 15 ppm over 15 minutes (API, 2001).

In December 2009, the European Union published its occupational exposure limit values (IOELVs) for the protection of workers from chemical risks. The 2009 publication forms the third list of IOELVs where hydrogen sulphide limit values were set at a TLV of 5 ppm for 8-hour TWA and STEL of 10 ppm (ECD, 2009).

The operator, in consultation with the safety solutions company also reviewed the American Petroleum Institute’s (API) Recommended Practice 49 on Drilling and Well Servicing Operations Involving Hydrogen Sulphide and the API Recommended Practice 68 on Oil and Gas Well Servicing and Workover Operations Involving Hydrogen Sulphide.

These two documents underscore the importance of proper planning, selection and layout of equipment and materials, wellsites
safety and emergency procedures, appropriate safety equipment and personnel training when working with hydrogen sulphide.

As for the national requirements, the Romanian emergency body ISU Vranca required the operator to produce an ISU intervention plan in the event of a crisis at the well site. The former described in particular the readiness of the local ISU and outlined the requirements from the operator and subcontractors at the well site such as extinguishers, water tanks and placement of the same, work permit and hot work requirements.

Although a detailed geological mapping of the Adjud well was performed, insufficient data points were collected to confirm the H₂S content laterally across the reservoir or even vertically. There were minimal records of H₂S and CO₂ during the testing of the offset wells drilled in Adjud Prospect; however, these wells did not reach the test objective. The wells drilled in a neighboring structure; Burcioaia produced condensate and gas from Basal Sarmatian and Paleozoic with an H₂S concentration of about 2 ppm. This small percentage of gas was not considered dangerous and was not taken into consideration.

The parties concluded that all future operations assumed the worst case scenario. All operations were performed in 8% H₂S content areas (reservoir). Based on this conclusion, the operator proceeded to classify incidents as follows:

<table>
<thead>
<tr>
<th>C1</th>
<th>C2</th>
<th>C3</th>
<th>C4</th>
<th>C5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incident</td>
<td>Emergency</td>
<td>Crisis</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Human</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single person of the workforce is injured but able to continue work. First aid needed.</td>
<td>Single person of the workforce one or two days off work.</td>
<td>Single person of the workforce at least three work days lost</td>
<td>One fatality of workforce</td>
<td>Multiple fatalities (&gt;1) of the workforce</td>
</tr>
<tr>
<td>Single person of the workforce with minor reversible short-term health effect.</td>
<td>Single person of the workforce with moderate reversible midterm health effect</td>
<td>Single person of the workforce with onset / signs of moderate irreversible health effect</td>
<td>More than three people on-site hospitalized</td>
<td>One fatality of public</td>
</tr>
<tr>
<td></td>
<td>Single person of public with minor reversible short-term health effect</td>
<td>Single person of public with moderate reversible mid-term health effect</td>
<td>Single person of public hospitalized</td>
<td>More than six people of workforce and/or public hospitalized</td>
</tr>
<tr>
<td><strong>Environment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slight, reversible environmental damage within the boundaries</td>
<td>Slight, reversible environmental damage outside the boundaries</td>
<td>Short-term environmental damage within a limited area outside the boundaries</td>
<td>Mid-term, major environmental damage</td>
<td>Massive long-term environmental damage on a large area</td>
</tr>
<tr>
<td>Actions required for restoration.</td>
<td>Actions required for restoration.</td>
<td>Actions required for restoration.</td>
<td>Actions required for restoration.</td>
<td>Major actions are required to restore the environment</td>
</tr>
<tr>
<td><strong>Reputation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Awareness, no external concern</td>
<td>Local concern, limited impact and/or single complaints</td>
<td>Regional concern and/or many complaints</td>
<td>National concern</td>
<td>International attention</td>
</tr>
<tr>
<td><strong>Finance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; EUR 10,000</td>
<td>≥ EUR 10,000 up to &lt; 100,000</td>
<td>≥ EUR 100,000 up to &lt; EUR 2 million</td>
<td>≥ EUR 2 million up to &lt; 10 million</td>
<td>≥ EUR 10 million, impact on stock exchange and revenue</td>
</tr>
<tr>
<td><strong>Activation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activate the ERT and inform the IMT.</td>
<td>Activate the ERT and IMT. Inform the EMT. Notify the business senior management.</td>
<td>Activate the ERT, IMT and EMT. Notify the business senior management. Activate the support teams directly supporting the EMT.</td>
<td>Activate the ERT and CMT including all Corporate Support Teams. Notify the EB members.</td>
<td></td>
</tr>
</tbody>
</table>
Taking into consideration the above classification of incidents, emergency levels were classified as follows:

**Category 1**
Low alarm condition
- 10 ppm H₂S and/or 2 ppm SO₂
- Stop work, investigate alarm
- Report incident and remedy
- Return to work

**Category 2**
High alarm condition or danger to life condition at the rig site
- 20 ppm H₂S and/or 5 ppm SO₂
- Stop work, investigate alarm
- Remedy if possible
- Return to work
- Evacuate well site if necessary
- Shut in well if necessary
- Stop flaring if necessary
- Ignite rig if necessary

**Category 3**
High alarm, danger outside rig site
- 20 ppm H₂S and/or 5 ppm SO₂
- Stop work and investigate alarm
- Remedy if possible
- Return to work
- Evacuate well site if necessary
- Shut in well if necessary
- Stop flaring if necessary
- Ignite rig if necessary
- Evacuate village as necessary

Figure 1. Emergency Levels and Response Strategies

Category 4 and 5 response strategies which require the involvement of wide-ranging corporate, government and external agency resources such as the ISU, police, and the media are not covered in the above figure. The response strategies for these categories are discussed in the operator’s corporate Emergency Response Plan.

**Description and Application of Equipment and Processes**

The operator and the safety solutions company had a window of six months to plan the workover and well-testing activities in accordance with API RP 49 and API RP 68. The following sections outline how the operator in partnership with the safety solutions company designed the Emergency Response Plan, trained personnel and the community in the event of a gas leak. The figure below shows the timeline of activities:

Figure 2. Project Timeline

**Defining the Emergency Planning Zone**

An emergency planning zone (EPZ) needed to be defined to develop a contingency plan to protect workers and the nearby community during an emergency. A circle 394 meters from the well head was delineated as the EPZ, as a result, of detailed planning which includes the unique geographical features of the area, demographic information and other specific conditions. All necessary controls and precautions were established to cover this area of responsibility.
Monitoring Wind Speed and Direction

The operator set out to monitor the wind speed and direction in the vicinity of the 20 Adjud Exploration well to gather enough data for dispersion modeling. Wind speed and direction is an important component for dispersion models that include topography to accurately determine risks to surrounding communities. Four months of monitoring were conducted to make statistically valid conclusions. Figure 3 shows a sample of the data gathered from the four-month period.

Access to active areas within the Emergency Planning Zone (EPZ) where there was a potential to encounter an H₂S release, such as the well test area, auxiliary equipment, and flare lines were strictly controlled.

Barriers with “No Entry” signs, dependent on the alarm condition, were put in place and observed at all times. Muster points were determined up and downwind of the prevailing wind direction to ensure safe egress from the site.

Prevailing wind data was also considered in locating briefing (muster) areas at a safe distance or a 90-degree angle for wind direction shifts. At the 20 Adjud well, two areas were defined as safe briefing (muster) areas.

Windsocks were placed in strategic areas that are readily visible to personnel approaching the work area or briefing area, both in daylight and at night.

Defining the Emergency Awareness Zone

The Emergency Awareness Zone was delineated as the area in a circle with a radius of 600 meters from the well head. Although it is outside the emergency protection zone (EPZ), defining the EAZ is important to identify locations of residences, roads, public facilities and major industrial operations. The incident could impact them (i.e. they may smell strong odors or be affected, as a result, of wind conditions) due to their proximity to the site.

While the task of informing the public in the Emergency Awareness Zone falls under the local mayor’s office in conjunction with ISU Vranca (Romanian emergency body), the operator and the safety solutions company gathered the necessary information in case they needed information. In the event of an emergency evacuation, a list of all the local bus companies and their capabilities and contacts was also provided. The notification list included information regarding residents contracted for various ongoing area operations.

Monitoring, Detection and Alarm Systems

Fixed H₂S monitoring and detection system with audible and visual warning alarms were installed in strategic locations. These H₂S monitoring and detection systems were equipped with emergency battery power back-up, capable of keeping the system operational for 12 hours without recharging.

A multi-gas detector was also installed onsite to measure atmospheric concentrations up to 300 ppm. H₂S & SO₂ monitors were placed strategically around the main Flare stack (North, East & South some 45 m from the base of the flare stack) as these are crucial areas for both SO₂ and H₂S monitoring.

Remote H₂S and SO₂ sensor devices were placed strategically close to the houses and village area of Lespezi. These were set at 20 and 5ppm respectively.

Personal H₂S monitors were available for use by all key operations personnel on site. Portable sensors record eight hour weighted average exposure level information. A regular 4 hourly monitoring circuit was set up for SO₂ monitoring while the well was in well test mode and flaring. Portable sensors were used to ensure H₂S and SO₂ levels remain within safe limits within the community and at other social receptors.
Warning devices were installed at various stations on the drilling rig. All warning devices located in hazardous zones were appropriately certified as per ATEX regulations. Two manually activated warning buttons were available, one on the rig floor and one in the area of the testing equipment with a minimum 95dB horn system.

Below is the list of the location of H₂S warning alarms, audible and visual:

- driller’s console (audible and light);
- engine’s area (audible and light);
- mud pit area (audible);
- living quarters (audible at all levels);
- main office of the rig (audible and light);
- shale shakers area. (light)

A rig layout diagram clearly indicating the location of all H₂S sensors and safety equipment, including cascade plug in points was posted beside the master list on the rig. All rig workers were notified of the equipment’s location and given appropriate training.

On top of these, three alarm sirens of 112db are placed on the well site perimeter fence facing the main village area. These alarms would only be activated manually by the Well Services Supervisor in the event of an uncontrolled influx that requires “rig ignite” action. There were three manual activation buttons; one in the office and one at muster points A and B.

**Personnel Training**

All employees were required to have a valid Mavlo 1 and Mavlo 2 certificates (Romanian HSE training) and also a valid H₂S certificate. The H₂S related training courses were made in compliance with international API RP-49, API RP-68 and API RP-55 Recommended Practice for Oil and Gas Producing and Gas Processing Plant Operations Involving Hydrogen Sulfide.

To ensure the safety of all workers, the operator committed a substantial financial capital to train not just their company personnel but all contractors, subcontractors and the local fire fighters. The comprehensive training on H₂S operations delivered by the safety solutions company covered API RP-49 and OSHA recommended skills not limited to the following:

- identification of the characteristics, sources, and hazards of hydrogen sulfide;
- proper use of the hydrogen sulfide detection methods used on the site;
- recognition of, and proper response to, hydrogen sulfide warnings at the workplace;
- symptoms of hydrogen sulfide exposure;
- proper rescue techniques and first-aid procedures to be used in a hydrogen sulfide exposure for those who were designated as Emergency Rescue Team (API, 2001);
- proper use and maintenance of personal protective equipment including a demonstration in using PPE;
- awareness and understanding of workplace practices and maintenance procedures to protect workers from exposure to hydrogen sulfide;
- wind direction awareness and routes of egress;
- confined space and enclosed facility entry procedures;
- locations and use of safety equipment;
- locations of safe briefing areas;
- use and operation of all hydrogen sulfide monitoring systems;
- emergency response procedures, corrective action, and shutdown procedures;
- effects of hydrogen sulfide on the components of the hydrogen sulfide handling system;
- the importance of drilling fluid treating plans prior to encountering hydrogen sulfide (OSHA, 2014).

Visitors on the rig site were also required, as part of their normal induction, to undergo a full briefing on H₂S procedures.

The trainings were done to ensure that all of the working and non-working personnel at the 20 Adjud Well location would immediately respond to the H₂S alarm and listen attentively to the message over the PA system. Because of potential language barriers and the possibility of misunderstanding by drilling crew personnel, everyone was trained and conditioned to react to the audible and visual alarm system. The meaning of each warning signal was known to all personnel on or around the worksite.

Workers were also trained to initiate the “Buddy System” (working in pairs) to facilitate personnel egress during emergencies. This would be terminated by the Well Services Supervisor when H₂S is no longer detectable in the atmosphere.
Essential personnel were considered to be the Driller, Rig Toolpusher, Derrickman, and lead personnel from the oilfield service company. Meanwhile, the Emergency Response Team (ERT) was made up of on-tour roughneck and two roustabouts. These designated personnel were made fully aware of their responsibilities. They were trained in the use of breathing apparatus, search and rescue operation and first aid treatment and were ready for action. Their names were posted in the muster points and main offices.

**Onsite and Offsite Drills**

The drilling contractor put in place a comprehensive H₂S drill procedure that was agreed and practiced multiple times prior to commencement of operations. The same drill procedure was practiced during the operations together with the service contractors (H₂S service contractor included).

Emergency H₂S drills were conducted prior to entry into a known, unknown or suspected H₂S zone or prior to commencing any special operations such as venting operations, wireline operations, coiled tubing operations, and well-testing operations. The drills covered emergency muster, use of Self-Contained Breathing Apparatus (SCBA) and cascade system, rescue and initiation of emergency evacuation procedures. Prior to operations start up, numerous drills were conducted to ensure that all personnel were able to react in an orderly and timely manner in the event of any emergency.

One drill was done every three days to ensure that everybody at the wellsite was confident with equipment usage and able to respond to emergency situations. A total of 20 emergency H₂S muster, “man down” and evacuation drills conducted while testing.

Conducting offsite drills with the community made them understand that only authorized personnel may enter the area once roadblocks are set-up. At Level One, a roadblock was established at the incident site and at a Level Two Emergency the emergency planning zone was to be isolated.

Potential roadblock locations were identified based on EPZ calculations; however, the public was made to understand that roadblock requirements could be adjusted to secure the EPZ as defined by the Incident Commander in conjunction with monitoring or sampling personnel. Initially, drills were made to assure that two roadblocks (at the bridge just off the main road in the village and on the road the other side of the campsite) effectively isolate the EPZ.

Arrangements were made with the local mayor’s office and the local police to assist with establishing any roadblocks on main highways. The parties agreed that should the area closure be considered long-term (i.e. > 12hrs), the operator would hire a safety or security company to operate the roadblocks. Roadblocks were equipped with appropriate safety, breathing and monitoring equipment. If H₂S or SO₂ levels were being measured, personnel would maintain records and report to the ISU representative on a regular basis.

**Emergency Response**

In the event of an emergency, the operator and the safety solutions company identified an Incident Command Centre (ICC) to serve as the primary evacuation response location. The ICC was located at the rig camp site 600 meters away from the well. The ICC was located as close as reasonably possible to the well site, but outside the EPZ and in an area opposed to the prevailing wind. In the event that the ICC gets compromised, a separate area would be made available not too far from the site but in a secure area.

Below is the detailed response guideline table developed for 20 Adjud well:

<table>
<thead>
<tr>
<th></th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Isolation</strong></td>
<td>Roadblock set up at site security checkpoint.</td>
<td>Roadblocks set up based on wind direction within EPZ or at outer edge.</td>
<td>Roadblocks set up based on wind direction at the outer perimeter of the EPZ, may expand into the EAZ</td>
</tr>
<tr>
<td><strong>Personnel</strong></td>
<td>Only authorized personnel on site</td>
<td>Authorized personnel within affected area</td>
<td>Authorized personnel within EPZ</td>
</tr>
<tr>
<td><strong>H₂S / SO₂ Monitoring</strong></td>
<td>Within the well location, mobile monitor set up around wellsite</td>
<td>Within the well location, the mobile monitor set up based on wind conditions and direction between wellsite and public. Determine outer perimeter of plume</td>
<td>Within the well location, the mobile monitor set up based on wind conditions and direction between wellsite and public. Determine outer perimeter of plume</td>
</tr>
<tr>
<td><strong>Observation Post</strong></td>
<td>Personnel will be requested by H₂S Safety to be on “Alert Standby”</td>
<td>Personnel requested by H₂S Safety to become mobile, follow evacuation routes and remain in contact with H₂S Safety personnel to determine the extent of zone expansion.</td>
<td>Personnel requested by H₂S Safety to become mobile, follow evacuation routes and remain in contact with H₂S Safety personnel to determine the extent of zone expansion.</td>
</tr>
<tr>
<td><strong>Entry Control Point</strong></td>
<td>Requested by H₂S</td>
<td>Personnel requested by H₂S Safety to become mobile, follow evacuation routes and remain in contact with H₂S Safety personnel to determine the extent of zone expansion.</td>
<td>Personnel requested by H₂S Safety to become mobile, follow evacuation routes and remain in contact with H₂S Safety personnel to determine the extent of zone expansion.</td>
</tr>
</tbody>
</table>
Safety to be on “Alert Standby” evacuation routes and remain in contact with H₂S Safety personnel to determine the extent of zone expansion.

<table>
<thead>
<tr>
<th>Evacuation Criteria</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within Monitoring Zone</td>
<td>≤ 1 ppm H₂S</td>
<td>2 – 9 ppm H₂S</td>
<td>≥ 10 ppm H₂S</td>
</tr>
<tr>
<td>Informed of the concentrations and advised to be on alert</td>
<td>Informed of the concentrations and requested to Shelter-in-Place</td>
<td>Immediate evacuation of the area must take place</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Evacuation Criteria</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within Monitoring Zone</td>
<td>≤ 1 ppm SO₂</td>
<td>2 ppm SO₂</td>
<td>≥ 5 ppm SO₂</td>
</tr>
<tr>
<td>Advise members of the public to evacuate the area on a voluntary basis</td>
<td>Evacuation of the area should begin</td>
<td>Evacuation is mandatory</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Emergency Response Guideline for 20 Adjud Well

Presentation of Data and Results

Proper training of personnel and local firefighting brigade

As directed by the operator, the safety solutions company trained all wellsite personnel on H₂S Awareness and Emergency Response. At the end of two months, the safety solutions company issued more than 400 training completion certificates which include community leaders and members of the local firefighting brigade. Below is the breakdown of trainings conducted during the period.

<table>
<thead>
<tr>
<th>Date of Training</th>
<th>Venue/Location</th>
<th>No. of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>March 2011</td>
<td>20 Adjud Well</td>
<td>161</td>
</tr>
<tr>
<td>April 2013</td>
<td>20 Adjud Well</td>
<td>227</td>
</tr>
<tr>
<td>May 2013</td>
<td>20 Adjud Well</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total No. of Participants 425</td>
</tr>
</tbody>
</table>

Table 3. List of Trainings

They also issued instructions specific to the H₂S hazard prior to commencing and resuming the operations at 20 Adjud Well (well reopening and testing). The instructions covered locations where H₂S may be expected, areas permitted by essential personnel only, emergency assembly areas, applicable warning signals and response strategies in the event of an emergency, including the use of protective equipment, if required and a briefing on emergency action and evacuation procedures.

Proper equipment maintenance

On a daily basis, the safety solutions company ensured that all H₂S safety equipment were functional and tested by the Well Services Supervisor. The safety solutions company also ensured that all detection heads were set to provide a level of the low alarm at 10 ppm and high alarm at 20 ppm. The safety solutions company provided a comprehensive and agreed number of H₂S safety equipment at the well site.

The safety solutions company pioneered the use of a mobile onsite QA/QC facility and maintenance process in Romania. Breathing air equipment, and personal gas monitors complete a field maintenance cycle on a daily basis. Before safety equipment leaves the onsite QA/QC facility, safety solutions company personnel has thoroughly cleaned, readied, and inspected them as safe to use by wellsite personnel.

Active role of community in emergency response

By reaching out for the support of the local mayor’s office and the ISU Vranca, the operator was able to gather the support of the local community. Offsite drills were done in partnership with the community and the well-testing and workover operations were conducted smoothly.

The community understood that an evacuation is considered the primary protection measure. The mayor’s office would provide the necessary Shelter Reception Center located in the Homocea village, in the Camin Cultural, at the center of the village.

Mandatory evacuation would be initiated at a Level Two emergency; however, special needs residents would be notified and offered voluntary evacuation at Level One emergency. Evacuation would commence with those downwind and closest to the release.

Through consultation with the community, methods of contact and evacuation procedures were established and agreed upon by the community, the mayor’s office and the ISU Vranca. It agreed that the evacuation outside the EPZ and surrounding area
might be necessary based on air monitoring data. Air monitoring crews would report to the mayor’s coordinator who directs evacuation personnel to initiate appropriate evacuation measures.

**Conclusions**

*Value of continuous personnel training*

Workers in the Oil and Gas industry need continuous training to ensure they have the skills and knowledge to work and maintain a safe and healthy work environment. When workers are aware of their individual responsibilities and their contribution to the overall safety and reliability of the worksite, they understand that there is more at stake than just adherence to technical and procedural solutions and compliance with regulations. It is, therefore, necessary for operators and contractors to develop specialized training programs based on field realities and results from risk assessments. When the value of continuous improvement is stimulated, the workforce display improved efficiency thereby reducing operating costs by way of lesser incidents and productivity losses.

*Increased public confidence in operator*

The operator and the safety solutions company gained public confidence and support during the entire work over and well-testing activities because they practiced transparency including the openness to communicate about the risks involved in the operations. They countered fears by training their personnel. They proved their strong sense of accountability by training the surrounding community on H2S safety and conducting emergency drills. These activities showed their competence to respond appropriately in case of emergencies. By adhering to industry recommended best practices and going beyond regulatory requirements, the operator avoided costly incidents, enhanced their overall safety performance and built a strong relationship with the local leaders and the public.

*Setting a new benchmark for safety in Romania and Eastern Europe*

Over the past nine years, the operator has invested significant resources to support its comprehensive modernization and efficiency program. As a major employer and contributor to Romania’s economy, the company has invested heavily on developing safe work practices in upstream operations that drive efficiencies leading to cost savings and a host of other benefits. It may seem natural for operators to invest in safety systems and measures to safeguard workers. However, there is growing evidence that in the eyes of stakeholders and consumers, a company’s safety performance directly impacts customer satisfaction. By establishing a working relationship with a dedicated safety solutions provider and leading the safety program implementation, the company improved the reputation and overall sustainability of the Oil and Gas industry in Romania and Eastern Europe.

**References**


