**TITLE: - SOP FOR HANDLING MAINLINE EMERGENCY IN LPG PIPELINE (WITH WATER FLUSHING METHOD)**

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| **SL. NO.** | **ACTIVITY** |
|  | The following typical SOP should be followed in case of any emergency in LPG pipeline because of pilferage attempt, third party damage, corrosion leak, pipeline burst etc. The scenario is considered for such incidents in which LPG is leaking out from underground pipeline & excavation is not done yet. LPG is coming out of the buried pipeline through soil and there is LPG vapour cloud formation at site. SOS call is received from villagers & Police. |
|  | Take pipeline Emergency shutdown (ESD) as soon as communication about LPG leak is received and immediately stop all running MLPUs. LPG delivery at the other end of the pipeline (terminal) may be continued depending upon the situation. |
|  | Deploy QRT teams, security teams, Mutual aid partners at site and liaison/ coordinate with Police/ state administration and barricade the incident location for about 250 meters -500 meters radius depending on scenario at site. Deploy teams to divert the traffic, evacuate public from nearby places by using megaphones, public address system, emergency siren etc. |
|  | For each pipeline section (between SVs/ dispatch/ pump/ receipt terminals), an evacuation plan shall be made based on the following:   1. With gravity, the LPG will evacuate easier towards the lower elevation. However, site location and overall hydraulic gradient profile of pipeline to be considered. 2. Bullets/ storage vessel available for the evacuation in upstream side/ downstream side based on the location of incident site. 3. In case evacuation by Emergency Evacuation Equipment (EEE)/ mobile flare/ or any other means is available, the same may also be evaluated in terms of overall evacuation plan. 4. If data with respect to integrity of immediate upstream/ downstream SV valves is available, it shall also be taken into consideration. 5. Considering the factors above, the decision to be taken for evacuation of the line (from upstream / downstream side or both side) to ensure safe evacuation at the minimum possible time. 6. It is recommended that for each pipeline section, this plan should be prepared and available beforehand. 7. If the pipeline company does not own their tankages, then pipeline company transporting LPG through a pipeline, should promptly come into action for evacuation of the pipeline content up to maximum extent possible. 8. Based on the evacuation plan, all SVs on one side with respect to leak location are to be closed (to ensure positive isolation) and on other side, SVs are to be opened, and LPG is to be taken in bullet/ Storage vessel of terminal station / pumping station depending on downstream/upstream, so that section is depressurized up to 7.0 to 8.0 kg /sqcm. 9. After line pressure is reduced to 7.0 to 8.0 kg/sqcm, SV on other side of leak point shall be closed and section is isolated from rest of pipeline. Evacuation of LPG from isolated pipeline section through ERV (Emergency Response vehicle) shall be started. ERV is placed inside SV station and is having vacuum pump for sucking LPG liquid / vapour, compressor for converting LPG vapour into LPG liquid and suitable pump to pressurize LPG back into the pipeline section, which is adjacent to isolated section on both sides. Multiple ERVs can be deployed at both upstream & downstream SV stations if space permits. If not, at least one ERV to be deployed at each SV station for evacuation of LPG from isolated pipeline section. Provision of ERV to be ensured by entity or they can take help of mutual aid partners for deployment of ERVs. 10. In case ERV is not available in extreme cases, there is also an option of evacuation of LPG from affected pipeline section to Bullet/storage vessel/ Hot flare unit namely Emergency Evacuation Equipment (EEE) through suitable piping from bypass line or blowdown line. Necessary permanent modification is to be made to all SV stations. 11. Parallel arrangement for LPG evacuation by EEE and ERV or any other safe and reliable method can also be opted. |
|  | Since LPG is leaking from ground level, do not try for excavation by machines like JCB, as this can create a hazardous situation and aggravate the situation. |
|  | Mobilize fire tenders at site for water spraying / sprinkling (from a safe distance) in case LPG vapour cloud is observed at leak site. LEL to be monitored continuously at site. This activity should continue to remove vapour clouds at the site. Spray water directed towards sky using water curtain nozzles or universal nozzles. Water to be thrown in fine sprinkler mode to minimize LPG vapours at leak site. Heavy duty air compressors for “dispersing LPG vapour towards safe direction” also to be used intermittently in between water sprinkling / spraying. Parallelly, below mentioned activities may be carried out. |
|  | Once the situation is under control at site and water sprinkling is done at leak site, take action for pig insertion through pigging valve (3-way valve) at one of the planned SV locations (either upstream or downstream) based on hydraulic gradient along with water injection. The pressure of water shall be higher as compared to residual LPG pressure for pig movement (approx. 2 kg/sq.cm more than residual LPG pressure). Suitable piping arrangement (permanent type) for pig insertion, launching, water injection shall be made available at all SV stations. Pig receipt and Water draining facilities can be provided either at all SV stations / select SV station or at terminal location as per requirement as decided by entity. |
|  | Based on the estimated total LPG evacuation flow rate (via different modes like EEE, ERV etc.), pumping of water to be carried out so that LPG can be evacuated in a controlled manner. Accordingly, estimated time for water to reach at leak site to be also calculated |
|  | Once pig and water plug start from one SV & move towards other SV, pig will displace LPG in front of pig (in the direction of pig movement) because of pig plus water plug movement. Allow pig and water plug to reach second SV, so that the entire section is filled with water plug. |
|  | As both SV valves are closed and the section is completely water filled |
|  | Please note that both pig & water plug are launched through the same piping arrangement. When pig along with water plug are moving, there is likely hood of increased leak from leak site due to pig movement. Necessary care at site to be taken to remove increased vapour cloud by more water sprinkler / water spraying. LEL to be monitored continuously at site by using portal gas detector |
|  | Once the entire section between two SVs is filled with water plug, it can be observed that vapours from leak site will start decreasing slowly and LEL becomes zero |
|  | Now the entire pipeline section between valves of leak site is filled with water under pressure |
|  | Depressurize water in the section and make it zero pressure. Then insert wooden plug-in hole of Pilferage clamp or corrosion pin hole, remove pilferage clamp & install suitable leak repair clamp |
|  | In case of any major defect in pipeline like crack/burst, take action for replacement of damaged section of pipeline with hydrotested pipeline section by cold cutting old section (by using non sparking special cutters) & welding new section. Before welding of new section, old sections to be plugged at both ends by using mixture of mud & Bentonite |
|  | For safe working at site, plan for water accumulation and its evacuation should also be  considered. Windsock can be installed at site to assess the direction of wind flow. 16. Before doing repair work/cutting & welding, carry out JSA, toolbox talk etc. and execute repair work as per tested and conventional SOPs by taking all safety precautions. LEL level shall be monitored continuously during the entire job |
|  | The above SOP can be altered/ modified as per site specific conditions and available resources considering risk assessment & with management approval. Any other alternate/ suitable mechanism for displacement of LPG from the section can also be explored by the entity based on technology intervention / upgradation |
|  | In case the entity chooses to adopt this method for the emergency handling and evacuation of affected, necessary arrangements for water pumping/ storage and pigging shall be available at SV locations (or selected SV) for all new projects. For existing pipelines, either new modifications may be carried out for water/pig injection facilities at SV locations or emergency handling procedure/ provision as per nitrogen purging system or any other alternative effective system to be made available.  Minimum required machinery:   * + Minimum 2 Fire tenders for water spraying / water sprinkling   + 2 Nos. heavy duty air compressors   + Water storage (50KL), water pumping facilities, water injection & pig insertion facilities (3-way pigging valves of API 6D) at all SV locations of LPG pipeline   + Suitable pig for displacement of LPG from pipeline. * Non sparking cold cutting machinery & other machinery for mainline pipe replacement job |
|  | **Notes:**   1. The above procedure is a typical procedure for LPG evacuation using 3-way pig valve installed (at each SV location (or selected SV) or at strategic locations based on the nature of the pipeline / location / volume handled etc.) where leakage has occurred at point in main line between two SV stations which are away from any immediate storage facility on either upstream side or downstream side. The entity can adopt this evacuation plan and accordingly make the necessary provisions of 3-way pig valve/pigging/ evacuation/ water injection etc. arrangements in new projects or may carry out the necessary modifications in existing pipelines also based on the evacuation and emergency handling procedure adopted by the entity. 2. In case of leakage has occurred between smaller pipeline sections (e.g. small spur lines) where pigging facilities are available at both the ends of leakage section, water injection and pigging should be carried out towards the end where LPG storage is available. In such lines, all the above procedures can be adopted except that instead of 3-way pig valve, pigging and water injection can be carried out at the launcher barrel as per the available facility/ practice adopted. 3. The procedure described shall be periodically (but not later than once in a year) tested for suitably by organizing mock drills. Reports of such drills shall be recorded in detail and shared with OISD. As many stakeholders as possible like Police, Administration, villagers etc. shall be involved during the mock drill. |