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EFFECTIVE WORK PERMIT SYSTEM TO MINIMIZE THE HAZARDS IN EID PARRY (INDIA) LIMITED

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ABSTRACT

The human element of the system has one of the biggest potentials for either causing or preventing an accident. Safe job performance by operating, maintenance personnel and contractors has a tremendous positive impact on safety. The Permit System is an important element of safety management system and implementation of this in true spirit shall help in ensuring a safe working environment, thereby reducing the possibility of injury to personnel, protect property, and avoid fire, explosion & adverse effect on the environment. A permit-to-work system is a formal recorded process used to control work which is identified as potentially hazardous. It is also a means of communication between site/installation management, plant supervisors and operators and those who carry out the hazardous work. Essential features of permit-to-work systems are clear identification, training and standard control measures. In this thesis various types of work permit systems such as confined space entry, hot work permit, excavation permit, radiation permit, electrical isolation and work at height permit are discussed. The methodology to develop a new effective work permit system is also given.

KEYWORDS:

permit-to-work;
Confined Space Permit;
scaffold materials;
Pre-Erection;
Excavation Permit.

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1. INTRODUCTION

The process industries store and process large quantities of hazardous substances, including flammable and toxic materials, so the potential for serious incidents is clear. To prevent such incidents, it is vital that there should be an effective management of hazards, including the use of safe systems of work. A permit-to-work system is an integral part of a safe system of work and can help to properly manage the wide range of activities which can take place close together in a small space, such as in a storage area or process plant. When incidents do occur, human factors, such as failure to implement procedures properly, are often a cause. These failures may in turn be attributable to root causes such as a lack of training, instruction, communication or understanding of either the purpose or practical application of permit-to-work systems. Permit-to-work systems form an essential part of the task risk assessment process. When a task is identified an appraisal should be carried out to identify the nature of the task and its associated hazards. Next, the risks associated with the task should be identified together with the necessary controls and precautions to mitigate the risks. The extent of the controls required will depend on the level of risk associated with the task and may include the need for a permit-to-work.

A permit-to-work is not simply permitted to carry out a dangerous job. It is an essential part of a system which determines how that job can be carried out safely, and helps communicate this to those doing the job. It should not be regarded as an easy way to eliminate hazards or reduce risk. The issue of a permit does not, by itself, make a job safe - that can only be achieved by those preparing for the work, those supervising the work and those carrying it out. In addition to the permit-to-work system, other precautions may need to be taken - eg process or electrical isolation, or access barriers - and these will need to be identified in task risk assessments before any work is undertaken. The permit-to-work system should ensure that authorized and competent people have thought about foreseeable risks and that such risk are avoided by using suitable precautions. Those carrying out the job should think about and understand what they are doing to carry out their work safely, and take the necessary precautions for which they have been trained and made responsible.

2. OBJECTIVES

The purpose of this standard is to describe procedures and guidelines on work permit system to carry out jobs of inspection, testing, maintenance, alternation, repair, up equipment and construction in the safest possible manner. The implementation of this system will help in bring down the risks at work sites to an acceptable level, thereby

reducing the possibility of any accident, fire, explosion, property damage and adverse effect on environment.

The objectives and functions of work permit systems are as follows:

- Ensuring the proper authorization of designated work. This may be work of certain types, or work of any type within certain designated areas other than normal operations;
- making clear to people carrying out the work the exact identity, nature and extent of the job and the hazards involved, and any limitations on the extent of the work and the time during which the job may be carried out;
- Specifying the precautions to be taken, including safe isolation from potential risks such as hazardous substances, electricity and other energy forms.
- ensuring that the person in direct charge of a unit, plant or installation is aware of all hazardous work being done there;
- providing not only a system of continuous control, but also a record showing that the nature of the work and the precautions needed have been checked by an appropriate person or people;
- providing for the suitable display of permits
- providing a procedure for times when work has to be suspended, ie stopped for a period before it is complete
- providing for the control of work activities that may interact or affect one another
- providing a formal handover procedure for use when a permit is issued for a period longer than one shift
- providing a formal hand-back procedure to ensure that the part of the plant affected by the work is in a safe condition and ready for reinstatement
- Providing a process for change, including the evaluation of change on other planned activity, a determination of when hazards need to be reassessed, and a means for controlled communication of change.
- A permit-to-work system will be more effective if site management and other personnel have been consulted. Imposing systems without consultation can lead to procedures that do not reflect the needs of maintenance staff, for example. Procedural violations are then more likely.

3. LITERATURE REVIEW

R.E. Iliffe., P.W.H. Chung, T.A. Kletz (Fellow). "More Effective Permit-to-Work Systems" (Science Direct). Many incidents in the chemical-industrial workplace associate with maintenance works, which are typically controlled by permits-to-work (PTWs). Computerized PTWs have advantages of flexibility and informational clarity, and allow closer coordination of activities and integration with computer applications. A system has been developed linking computerized PTWs with an incident database: the system examines the nature of the job, equipment and chemicals specified on the PTW and draws users' attention to relevant incident reports without requiring explicit searches or further data; unknown or forgotten hazards are thus highlighted when preventative action may still be taken.

Michael Booth, John D. Butler**.** "A new approach to permit to work systems, offshore" (Science Direct). On the 6th July 1988, the North Sea oil installation Piper Alpha was destroyed following a series of explosions and a major fire. One hundred and sixty-five men lost their lives. One of the most significant causes of the tragedy on Piper Alpha was the breakdown in coordination of hazardous activities. This should have been achieved through the Permit to Work procedures. The failure of these procedures led many operators of offshore oil installations to review their own systems. This article is about the radical overhaul of the Permit to Work procedure of one of the largest operators, Shell U.K. Exploration and Production and the introduction of the revised systems to over thirty of its installations over a period of 18 months.

A. Fakhru'l-Razi, S.E. Iyuke, M.B. Hassan[2], M.S. Aini "Who Learns When Workers are Trained? A Case of Safety Training of Maintenance Contractors' Workers for a Major Petrochemical Plant Shutdown" This study evaluated the safety training for petrochemical plant maintenance contractors' workers for a major plant shutdown at a refinery and the correlation between knowledge gained and levels of education. The training was divided into four courses, which were Introduction to Safety, Hydrogen Sulphide, Confined Space and Permit to Work, which were given before starting the job. It is normal practice in any oil, gas and petrochemical plant that contract workers (ranging from 700 to 3000 in Malaysia) are engaged to perform maintenance and modification jobs during any plant shutdown. The first and second levels of Kirkpatrick's evaluation, training were chosen to evaluate the training exercise.

S. Matsuoka, M. Muraki**.** "Implementation of Transaction Processing Technology in Permit-to-Work Systems" (Science Direct). Transaction processing is a software a

technology that enables concurrent management of large distributed systems. This concept is also meaningful in the control of work processes in chemical plants. In order to protect workers from exposure to hazardous energy sources, permit-to-work systems must be put to effective use, which requires site managers to devote a great deal of time to the reconfirmation of work plans. Although transaction processing can update databases without contradictory reading or writing, the technique is not adequate for controlling substantial operations. In the present study, we represented a framework of secure work control systems and synthesized timing of communications between site managers and workers, thus eliminating discrepancies between stored data in the system and substantial plant conditions. As a result, the concept of transaction processing technology that constructs granulated and isolated data processing enables implementation in permit-to-work systems.

3.1. Case Study from HSE

In September 1992, a jet of flame erupted from an access opening on the side of a batch still at Hickson and Welch, Ltd, Castleford, West Yorkshire. Five people were killed when the flame destroyed a control room adjacent to the still and damaged the nearby office building. The incident happened while a job was underway to rake out a residue that had built up in the still in the 30 years since it entered service. There were a number of failings identified during the HSE investigation including:

- Failure to analyze the sludge and the atmosphere in the vessel prior to starting the job;
- Failure to control the temperature of the steam used to soften the sludge,
- Resulting in temperatures in excess of 90 °C being applied;
- Use of a metal rack in a flammable atmosphere; and
- Failure to properly isolate the vessel prior to the job.

A permit-to-work system was in place on the site and two permits were issued, one for removal of the lid to the access opening and one for blanking the still inlet base. No permit was issued for the actual job to be done. Had a permit been issued for the raking out of the residue then the permit-to-work system may have allowed identification of the hazards associated with the job and allowed controls to be put into place that could have prevented the incident.

3.2. Case Study from HSE A major vapour cloud explosion at a chemical complex in Pasadena, USA in 1989 killed 23 people and injured 300. The incident occurred during

maintenance work on a reactor vessel which was being carried out by a maintenance contractor. During the investigation, it was discovered that there was no effective permit-to-work system in operation that applied to both company employees and contractors. This lack of an effective system led to a communication breakdown and work taking place on insolated plant.

3.3. Case Study from HSE

During the Piper Alpha inquiry it was found that ,contrary to the written procedure, the performing authority's copy of the permit was frequently not displayed at the job site, and was commonly kept in the performing authority's pocket. Lord Cullen made a specific recommendation on this point:

'Copies of all issued permits should be displayed in a convenient location and in a systematic arrangement such that process operating staff can readily see and check which equipment is under maintenance and not available for operation.'

4. TYPE OF WORK PERMIT, CLEARANCES AND FORMATS

Depending on the nature of the job, there are 7 types of work permit formats covering various works as mentioned below:

4.1 Cold Work Permit

This permit is required for carrying out any activity of maintenance/ cleaning / testing inside refinery that does not produce sufficient heat to ignite a flammable air-hydrocarbon mixture or a flammable substance. "Do's and Don'ts for Cold Work Permit" duly signed shall be attached with each permit. The list of job includes blinding, de-blinding of equipment/ facilities, tightening/ loosening of bolts, insulation, painting of lines, cleaning of equipment, repairing on instruments on facilities etc.

4.2 Hot work / Entry In To Confined Space Permit and clearances

Figure 1 Hot work / Entry in to Confined Space Permit and clearances

Hot Work Permit is required for carrying out any activity, which produces sufficient heat to cause fire in a inflammable air- vapour mixture. Entry to Confined Space Permit is required for entry into any confined space is shown in figure 1.

Duly signed "Do's and Don'ts for Hot Work Permit" shall be attached with each Hot Work Permit. Similarly duly signed "Do's and Don'ts for Confined Space Entry" shall be attached with each Permit for Confined Space Entry.

Before Issuing Permit for "Entry into Confined Space", the requirement of "Pre Entry checklist for Confined Space" format shall be complied.

The attendance of each entrant of confined space shall be taken by an attendant at man way of equipment.

4.3 Excavation Permit and Clearances

Figure 2 Excavation permit and clearances

Excavation permit is required for carrying out any excavation inside the industry. Duly signed "Do's and Don'ts during Excavation Work" shall be attached with each Excavation Permit. Duly filled signed and registered "Excavation Clearance" is prerequisite for any Excavation Permit is shown in figure 2. Wherever temporary closure of road / cutting off road or blockage of main roads are required in an industry. The necessary approval shall be obtained. The information about the closure of main road shall be circulated.

4.4 Electrical Isolation and Energisation Permit and Clearances

Figure 3 Electrical Isolation and Energisation Permit and Clearances

For all electrical isolation and energisation of electrical equipments (HT) "Electrical Isolation and Energisation Permit-HT" Permit is required.

For all electrical isolation and energisation of electrical equipments (LT) "Electrical Isolation and Energisation Permit-LT" Permit is required.

To work on High Tension (HT) line and / or equipment, "Permit to work on High Tension (HT) Line /Equipment" is required.

To work on Low Tension (LT) line and / or equipment, "Permit to work on Low Tension (LT) Line /Equipment" is required.

For Trip reset of HT equipment, the clearance shall be taken on format "Trip Reset Clearance Certificate for HT Equipment" as shown in figure 3.

4.5 Working at Height Permit

For all working at height (of 2M or above) a permit for "Working at Height" is required. Before erection, when scaffold materials are kept on site erection, "Pre Erection Checklist for Scaffold" shall be carried out in prescribed form. All tubular scaffolds needs to checked and certified before being used. The medical certificate for workmen, required to work at height is required as shown in figure 4.

Figure 4 Working at Height Permit

4.6 Radiation permit

The all jobs, which generate ionizing radiation, "Radiation Permit" is required

5. GENERAL REQUIREMENTS OF WORK PERMIT

All maintenance/ alteration/ construction jobs in the refinery shall be carried out under valid "Permit to Work" only. Normally operating personnel do not require a work permit for carrying out routine work, however in exceptional cases where they are likely to be exposed to certain risks, work permit is required. The requirement of work permit in

such cases is to be decided by FPS of the area/ Unit in-charge. Separate permit should be issued for each job. Multiple jobs in a single permit are prohibited, except Entry to confined space and hot work inside the confined space in particular equipment. In such cases a composite permit can be issued and permit must address all the applicable aspects for both the works.

Depending on nature of jobs, type of permit required shall be decided. Working at Height Permit' shall be required for working at a height of 2.0 meters and above on a temporary structure or on a fixed structure, not meant for carrying out particular job safely.

- For all scaffolds, pre-erection checklist in prescribed form shall be carried out before the start of erection and the safety guidelines shall be complied.
- Safety harness with lifelines secured with a fixed structure is a must for working at height.
- Provision of safety net should also be made.
- All scaffolds shall be checked and certified in the prescribed form before use.
- The workmen involved in working at height should have a medical certificate from a doctor.

Permit for working at height jobs, the following is to be ensured:

- All tools should be carried in tool kits to avoid their falling.
- Throwing or dropping of material/ equipment from height is prohibited.
- Avoid jumping from one member to another of a structure. Use proper passageway.
- Both hands should be free, while climbing the ladder. Bypassing the steps the ladder should be avoided.
- Avoid movements on overhead beam without proper fall protection.

All excavation permits, excavation clearance is mandatory in prescribed form. Additionally, for Closure of road, permission to be taken in prescribed form and information of the same shall be circulated to all concerned in prescribed format.

For Excavation Permit jobs, the following shall be ensured:

- A warning or protective barricade of 1 meter height with red & white band/ self-glowing caution board should be provided around the excavation site.
- Excavated material should be piled at least one meter away from the edge of the excavation / trench or depth of the trench whichever is more.
- Provision of minimum two entries/exits should be made. Additionally, in case of the long trench for each 7.5 M and part thereof, there should one ladder.

- Safe angle of repose or proper shoring/strutting to prevent cave-in should be provided as per relevant codes and safe operating practices.
- Excavation clearance shall be obtained from various dept. in prescribed format before applying for an excavation permit.

For Radiation Permit jobs, the following shall be ensured:

- A warning or protective barricade of 1 meter height should be provided around the surrounding area, meeting the distance requirement as mentioned in permit and radiation sings & symbols to be displayed prominently by permission.
- Permit issuing authority shall satisfy that permit conditions are met before issuing permit. It is also to be ensured that permit conditions are maintained in the course of execution of the job.
- Before issuing a permit, equipment is to be inspected to ensure that the equipment/ facility is prepared for safe execution of the assigned work, the area is cleaned and all safety precautions have been adopted. Wherever necessary, ensure that equipment is isolated, drained/ depressurized, properly purged, water flushed, gas tested (including oxygen deficiency test) through portable gas meters and readings have been recorded on the permit.
- No hot work shall be permitted unless the Explosimeter shows zero. Entry into confined space, where no hot work is to be carried out, may be permitted if combustible gases are up-to 5% of the lower explosive limit (LEL). Entry with an air-supplied mask may be permitted with LEL up to 20 %. The oxygen level should be at least 19.5 vol. % and the concentration of toxic gases below the threshold limit (TLV for H2S- 10 PPM, CO- 50 PPM, Cl2- 1 PPM, NH3- 25 PPM & SO2- 2 PPM).

Confined Space box-up" clearance in prescribed form shall be obtained for only those spaces, where "Confined Space Entry" permit has been taken. The clearance shall be obtained in duplicate and a copy shall be returned to issuer on completion of work.

6. WORK PERMIT PROCEDURE

6.1 General Requirements

The Company Management shall issue the appropriate authority limits for various types of permits. Entire Company shall be divided into various zones. For each zone, Gas Safety Inspector (GSI) and Fire Permit Signatory (FPS) shall be authorized. Normally, 'A' and 'B' grade officers are made GSI and officers in grade 'C' and above are designated as

FPS. In addition, SRSM/RSM shall be authorized as FPS for the entire Company. All HODs of their respective area are authorized to sign as FPS. Dy. General Manager/General Manager at Company units shall authorize Gas Safety Inspectors (GSI), Fire Permit Signatories (FPS) and Permittee/ receivers for all types of work permit. List of authorized Gas Safety Inspectors, Fire Permit Signatories and Permittee/ receivers shall be updated and issued to all concerned at least once in a year. All permits shall be clearly filled for validity of time & date, nature of work and location of work by permittee/ receiver before seeking permit from issuer. For obtaining work permit, permittee shall fill up above information and send duly signed copy to the issuer.

A Work permit is a document, which certifies that all practicable precautions have been taken for carrying out the job safely. Hence, it is desirable that the work permit form shall be filled up by the GSI after checking and ensuring that the site/ facility / equipment as mentioned in the permit is safe to perform the assigned job. GSI shall satisfy himself that all precautions have been taken to ensure that the work site is free from hydrocarbon & toxic gases and there is no oxygen deficiency and will remain so during execution of the job. After filling the permit format the issuer shall hand over the signed permit to the receiver. In case of Hot work/ entry into vessel/ Boxing up of vessel/ excavation/ Vehicle entry permit, FPS has to cross check that the preconditions of permit are complied at site, before signing the permit. The receiver will go through the permit, check the compliance and sign the permit before carrying out the job. The receiver will pass the necessary instructions to working personnel as mentioned in the permit before the start of the job.

In case, electricity is involved, GSI shall request the P&U Department for electrical isolation in prescribed permit. No work permit shall be issued unless electrical isolation is obtained. Extent of isolation for safe execution of the job shall be as per the standard on "Energy isolation- electrical and process"

Permits shall be available and displayed at the job site while the job is being executed. The issuer and F&S Dept. shall retain their copies of the work permit.

All copies of permits shall be collected, signed and returned to the issuing authority after completion of the job by the permit. It is to be ensured that the area has been cleared of all debris; scraps, additional materials etc. and all temporary electrical connections have been removed.

The issuer on receiving back the permit would satisfy himself regarding completion of the job and that the area has been cleaned and made safe for operation. On confirmation he shall also sign the Cold work permit/ Working at height permit/ Radiation permit and

keep the records of closed out permit for period of three months. In case of Hot work/ Entry to Confined Space and Excavation permit, the permit shall be forwarded to F&S Department along with the issuer's copy and the record of closed out permit shall be maintained at Fire & Safety Department for a period of three months.

All permits must be displayed at work site at suitable locations. To protect the permit from weather condition, it shall be displayed in waterproof plastic cover. Wherever required a separate stand may be kept at site to display the permit.

6.2 Cold Work Permit

Cold Work Permit in Prescribed format shall normally be valid for single shift only and clearance on the same permit can be renewed/ extended up to a maximum of seven calendar days. GSI/ FPS of the area shall issue clearance renewal in each shift after checking permit conditions/precautions and complying the same.

GSI/ FPS of the area is authorized to issue the permit.

The permit is issued in duplicate.The Original shall be issued to receiver /executer watermarked as “Executer copy” and 1st copy for the issuer shall be watermarked as “Issuer Copy.Th Permit shall be considered issued on signature of issuer and receiver. The original permit shall be watermarked as issuer copy and duplicate as executer copy.

Important Do’s and Don’ts copy (preferably bilingual- English and local language) duly signed by the Receiver and Issuer shall be attached to permit for Cold Work Permit. The copy shall be available on site along with the original permit copy.

6.3 Hot Work/ Entry into Confined Space

- Hot work / Entry into Confined Space Permit shall be filled in prescribed form. For each entry into confined space permit, the compliance of “Pre entry checklist for confined space” is a prerequisite.
- Permit shall be issued in triplicate. The original shall be for permittee/ executer shall be water marked as “Executer copy”. The duplicate shall be watermarked as “F&S Dept. copy” and triplicate shall be watermarked as “Issuer copy”.
- The permit shall be issued equipment wise, specifying the exact location of the work. Equipment number shall be categorically specified in the permit. Where the equipment number cannot be specified, the sketch of the area should be enclosed. In such cases the hot work permit can be obtained for a distance of only 15 M on either side the hot work spot. Beyond 15 M from the hot work spot,a separate permit is required.

- Normally permit shall be considered issued for the job after "Clearance renewal" is signed by GSI and the receiver. This clearance on the same permit can be renewed/ extended up to a maximum of seven calendar days. GSI/ FPS of the area shall issue clearance renewal in each shift after checking permit conditions and ensuring compliance.
- During Shutdown "Hot work / Entry into Confined Space" shall be considered issued for the job after "Clearance renewal" is signed. This clearance on the same permit can be renewed/ extended up to a maximum of fifteen calendar days and additional clearance sheets shall be attached to permit for extended clearance renewal. GSI/ FPS of the area shall issue clearance renewal in each shift after checking permit conditions and ensuring compliance of the same.
- Blanket hot work permit shall be issued with the authorization of DGM of issuing department for a period of maximum one month, where normal clearance renewal is not required for the same permit. While issuing permits the possible impact of nearby operating areas must be taken into consideration. For Q.C. Laboratory and Workshop or any place, where hot work is required almost every day and the area is safe for the hot job, the blanket permit can be issued after compliance of permit conditions.
- The main way for entry into confined space shall be manned by Attendant all the times, till last man comes out from inside. He shall maintain attendance sheet for all entries in prescribed form.
- For carrying out Hot work / Entry into Confined Space beyond normal working hours (General Shift) or on Sundays/Holidays, the clearance shall be obtained from SRSM/RSM.
- Whenever a hot job is discontinued at the work site for a day due to some reason, when the hot work permit is valid, the executor has to make an entry in the prescribed register at the Fire Station in advance. Fire station shall be kept informed when no job is done under the valid hot work permit. The compliance of permit conditions must be ensured by signatories (Issuer & permit) before restarting the work.
- "Do's and Don'ts" copy (preferably bilingual- English and local language) shall be attached to permit signed by the Receiver and Issuer for "Hot work/ Entry into

Confined Space permit". The copy shall be available on site along with the original permit copy.

- All hot work permits shall get automatically cancelled on occurrence of fire against that permit, unless it is rechecked & certified by issuer & Fire and Safety department officer. All such permits shall be withdrawn and handed over to Fire Station by the/ receiver of the permit.
- For further details about hot work refer Standard on "Hot Work" and for entry into confined space refer standard on "Confined Space Entry".
- Any heavy oil deposit, dried vegetation or other flammable / combustible materials within 8 M of a hot work site shall be cleared away.
- No hot work shall be allowed within 15 M of any sample point, drain or relief valve outlet unless precautions have been taken to prevent the escape of flammable liquids and vapour.
- If there is any drain or ditches into which flammable liquid can escape, the drain shall be dammed and pumped dry within 15 M of the work site.
- The outlet of all unit drain seals within 15 M of the hot work shall be plugged to isolate them from rest of the drain line.
- All drain covers and surface manhole covers within 15 M of the hot work site shall be covered by flame retardant fabric cloths / wet tarpaulin and wet sand. Particular care shall be taken to ensure that these seals are maintained in good condition.
- If welding or grinding is to be done at height, then precautions shall be taken to prevent the spread of sparks and molten metal by surrounding the work area with fire-resisting or flame retarding tarpaulin. Arrangement shall also be made to quench and extinguish sparks and molten slag by applying water through a hose.
- A minimum number of 2 fire extinguishers shall be available for each hot work within 8 M from the place of work.
- A hose with a control type discharge nozzle, capable of reaching up to the hot work point and connected to fire hydrant shall be provided during all hot work. There shall be either be a continuous flow of water through the hose or it shall be kept pressurized up to the discharge nozzle.

6.4 Excavation Permit

For excavation permit,the permittee shall obtain the Excavation clearance in the prescribed format from the respective discipline like Area in-charge, Civil Maintenance,

Electrical, Maintenance, Telecom, Production/ P&U, Instrumentation, Inspection and Fire & Safety as a prerequisite condition to permit two days before commencement of work. The clearance form shall be in duplicate. Original for permit shall be watermarked as "Executer copy" and duplicate for F&S Dept. watermarked as "F&S Dept. copy". Permit for excavation shall be in triplicate.The Original shall be watermarked as "Executer copy", duplicate for GSI watermarked as "F&S Dept. Copy" and third copy watermarked as" Issuer copy". For road cutting, approval from HOD of issuing Dept. in Excavation Permit shall be obtained. Additionally the permission for road blockade shall be obtained by Civil Department one day before the commencement of working prescribed format. HOD (F&S) shall circulate the road blockade information to all concern one day before commencement of work. In case of dyke cutting, permission the concerned DGM hall be obtained in prescribed form. For cutting tank dyke containing Hydrocarbons, the job should normally be carried out between sunrise & sunset and the site should be kept manned all the times. Wherever,the job is of continuous nature, the cut dyke should not be left unattended; unless it is temporarily closed with sand bags, G.I sheets etc. to ensure that in case of any leak, the oil should not come out of the dyke enclosure.

The Maximum validity of excavation clearance shall be for 15 days, except in case of construction sites & non-operational areas, where it shall be for a maximum period of 1 month. It shall be obtained at least 2 days before commencement of the work. If the work continues beyond one month, the fresh excavation clearance is required to be obtained. The excavation creance shall be followed by Excavation Permit, which shall be obtained at least 1 day before commencement of job.

The Excavation permit shall be issued in triplicate. At issue, the original shall be with executer, 1st copy with Fire Station and 2nd Copy with the issuer of the permit. To issue, the registration of permit is required to be done at the Fire station. This will be made for a maximum period of maximum 7 days with renewal in each shift by GSI. However, during shut down of units/ facilities the permit can be registered for maximum 15 days with shift wise renewal and during construction site for a maximum period of 30 days.

Other appropriate Work Permits are also to be obtained prior to start of excavation work. Copy of excavation clearance shall be attached to the Excavation Permit and serial number of excavation clearance shall be mentioned on the Excavation Permit. In addition to an Excavation Clearance, a Cold Work Permit is required if hand tools are being used for excavation or a Hot Work Permit if powered tools or mechanical equipment are being used. For excavations more than 1.2 meter deep a Confined Space Entry Permit is

required. Gas tests shall be done as per entry permit requirements. For any other work inside the excavation, appropriate work permits shall be obtained in addition to above. Executing Dept. officer (executor) shall ensure compliance to precautions specified on the Work Permits and Excavation Clearance.The Issuing authority shall monitor these conditions.

The Executor shall check the excavation safeguards, shoring, sloping and supporting system daily before starting the job and after every rainstorm or other hazard-increasing occurrence.Engine driven equipment should not be used inside confined excavations. If required, confined space precautions shall be followed. Exhaust gases from the engines of excavators, etc., shall be kept clear of the excavation. Trial excavations shall ensure the safety of underground facilities before use of mechanical excavators. Excavation work shall cease if any underground services are discovered or damaged during excavation.The Matter shall be reported to the concerned Division without delay. The work shall be restarted only after approval has been obtained from concerned Department. And a new Work Permit obtained. The Executor shall report any damage to underground services or any other incident immediately to the area in-charge.

Prevention of drowning**:** Adequate fencing, warning notices, etc., is to be provided around an excavation deeper than 1.2 meters and contains enough water to present the risk of persons being drowned. The fencing shall be removed only for the minimum time required for the passage of equipment and materials. If the excavation is in an area where persons could easily gain access, suitable rescue equipment such as safety harness with life line, lifebuoys, rescue jackets, inflatable boats etc. shall be provided on or near the site.

6.5. Electrical Isolation and Energisation Permit

Before issuing any permit for maintenance of equipment, having electrical connection, the Shift-in-charge (Operation) shall request the In-charge of P&U Dept. for isolating equipment electrically through format for “Electrical Isolation and Energisation Permit-HT” or “Electrical Isolation and Energisation Permit-LT” depending on the case. These permits have 3 parts with tear off facility; Part-III shall remain with Equipment custodian/ shift in-charge of the operation. Permits are issued in duplicate. Request for isolation shall be made by Shift in-charge to Electrical operation (P&U). After isolation, one portion of permit (Part-I) shall be returned to Operation in-charge. On completion of work the relevant portion of permit (Part-II) shall be forwarded by an Equipment custodian / shift in-charge of operation to electrical operation for re-energisation, which shall be done

and a copy of permit (Part-II) shall be returned to Equipment custodian / shift in-charge of operation by electrical operation.

Permit to "work on HT line & Equipment" or "work on LT line & Equipment" is an intra departmental protocol of Electrical Department and shall be used by Electrical Maintenance, Electrical Testing and Electrical operation. These permits have 3 parts with tear off facility and are issued in single copy. It shall be initiated by in-charge of electric maintenance (Part-1) and endorsed by an Equipment custodian / shift in-charge of operation before forwarding the same to electrical operation for de-energisation. After de-energisation, Permit to work certificate (Part-II) shall be initiated by electrical operation, which will be forwarded to electrical maintenance, which will do the job and issue to Job completion Certificate in the same form. Part-III of form for re-energisation shall be done by electrical operational and the certificate for re-energisation shall be issued in the same form.

- "Trip Reset Clearance Certificate for HT Equipment" or "Trip Reset Clearance Certificate for LT Equipment" shall be issued is duplicated by Electrical Operation to Equipment Custodian / Shift In-charge of operation as per requirement.
- Lock out and Tag out (LOTO) of equipments/ facilities will be integral part of the electrical isolation and the energisation permit system.
- After completion of maintenance activity, removal of man and material and clearing of site and ensuring that equipment is safe for operation, owner dept. agency shall declare that equipment is safe for operation and fill the clearance for charging which includes the date and time of returning the permit.
- After ensuring that equipment is safe for operation the electrical operation group shall energise the equipment. The date and time of energizing the equipment shall be recorded on permit.
- A list of personnel authorized for issuing electrical permits shall be issued by the HOD (P&U) and be prominently displayed in switchgear room. This list shall be updated annually or whenever there is a transfer/retirement of concerned personnel.

6.6. Permit for Working at Height

- Permit for Working at Height issued in prescribed format shall be considered issued for job after "Clearance renewal" is signed. This clearance on the same permit can be renewed/ extended up to a maximum of seven calendar days. GSI/ FPS of the

area shall issue clearance renewal in each shift after checking permit conditions and ensuring the compliance of the same.

- For carrying out job beyond normal working hours (General Shift) or on Sundays/Holidays, permission shall be obtained from respective HOD.
- Working at height should be avoided in adverse weather conditions, such as during rain, high wind, combination of high temperature & humidity.
- "Pre-Erection Checklist for Scaffold" shall be filled up and requirement shall be fully complied before going for erection of any tubular scaffold. The checklist shall be in duplicate. Original copy shall be for executer and duplicate for issuer.
- All scaffolds shall be of tubular construction and checked using prescribed format and certified before being tagged. No working at height permit shall be issued unless the scaffold is checked and certified in the prescribed form and tagged in green colour, showing "Ready for Use". In case a scaffold is in continuous use for more than a week, it shall be re-checked and certified at an interval of every week. A scaffold is also required to be checked and certified, whenever any alternation / modification is done in scaffold or if the scaffolds are subjected to severe climatic conditions. All scaffolds not ready for use shall be tagged in Red colour.
- The permit is issued in Triplicate. The original and 2nd copy will be for the Permittee/ Receiver. The Issuing authority will retain 1st copy.
- All ladders shall be inspected in prescribed format by custodian once in a month. Pre-use of ladder shall be a carried out by user before every use in prescribed format.
- The persons working at height should be medically examined for their fitness for working at height. The certified shall be issued by a registered medical practitioner and it will be valid for a period not exceeding 1 year.

6.7. Radiation Permit

- Radiation Permit shall normally be issued valid for single shift only and clearance on the same permit can be renewed/ extended up to a maximum of seven calendar days. GSI/ FPS of the area shall issue clearance renewal in each shift after checking permit conditions.
- Radiation permit is divided into two parts. Part-2 will be filled by radiography agency and officer of inspection department will endorse the permit. The permittee/ receiver shall fill the permit for validity of time & date, nature of work and the

location of work before seeking permit from issuer. For obtaining a work permit, permit shall fill up above information and send duly signed copy to the issuer. After checking and filling the Part-1 of the permit format the issuer shall hand over the signed permit to the receiver. The receiver will go through the permit, ensure the compliance and sign the permit before starting the job.

- GSI/FPS of the area is authorized to issue the permit.

6.8. Issue of Permit

Permittee i.e. under whose direct supervision the job is to be carried out shall raise the requirement for appropriate permission. All permits shall be issued in triplicate/ duplicate. Based on type of job, following permit shall be used:

a) Cold Work Permit
b) Hot Work/ Entry into Confined Space Permit
c) Excavation Permit
d) Permit for Working at Height
e) Radiation Permit

The permit for "Electrical isolation and Energisation Permit" shall be initiated by custodian of equipment (Operation in-charge), whereas "Permit to Work on High Tension/ Low Tension Line / Equipment shall be initiated by in-charge of electrical maintenance. In case the job is planned to be executed through a contractor, permit shall be raised and signed by maintenance/project/ construction engineer and not by the contractor. The period of validity, in terms of the date, start time and completion time should be entered.

The location of the work shall be specified clearly in terms of the plant, plant area, building, vessel or equipment. Identification number of the equipment shall be mentioned. Wherever it is necessary location sketch should be attached with the permit for clarity. Area in-charge / GSI shall check the permit conditions prescribed in the format. Permit shall be issued only after satisfying all the conditions. Additional precautions and remarks, if any, shall be clearly mentioned. All the items shall be marked appropriately in the boxes under heading "Done" and "Not required".

7. TRAINING AND AWARENESS

Any person who is authorized to issue or receive the work permit shall be imparted training for a period of not less than one day covering various aspects of work permits system. Further all the person authorized to issue/ receive the work permit shall be given a minimum of one day training once in two year on the work permit system and records maintained. Training and awareness programs are to be organized from time to time for

issuer & receiver of permit to make them conversant about work permit system. These programs should include "class room" as well as "on the job training" like.

- Filling of permits, assessing hazards and correction, the Work Permit procedure.
- Atmosphere monitoring with portable gas testers.
- Use of PPE including SCBA & airline respirators
- Carrying out different jobs safety

Awareness programs should be arranged in the form of "Class room training" as well as "On the job training" for contractors (Supervisor and their workmen) about work permit system.

8. AUDIT OF WORK PERMIT SYSTEM

The Work Permit System shall be audited at least annually by a multidisciplinary team constituted by refinery management for the purpose. For the audit the detail format shall be developed by the refineries. The audit shall include checking of procedure for permit/ clearances being followed and physical check at the site. The guidelines for audit checklist are as follows:

The permit, clearances and format have been properly filled up and recommendations are mentioned categorically.

The permit signatories, including HOD and DGM are trained and they have been trained within 2 years. Check the content of the training program to assess the coverage on "Work Permit System" . Ask questions from workmen, supervisors, and signatories of permit about their knowledge of subject to assess the effectiveness of training programs.

- Check for training record of toolbox talk and their effects of training.
- Check for the detail procedure, including the closing of permits, record keeping.
- Check work sites to observe deviations from procedures, permits, clearances and format.

9. METHODOLOGY

9.1. Setup of Work Permit Systems

Work with the joint health and safety committee or health and safety representative in setting up the system, and document all stages of the process.

9.2. Establish the Policy

The policy should:

- Emphasize the importance of a work permit (it's easier to implement a policy when employees understand why it's needed)

- specify that a work permit will be needed for all high risk work activities
- identify the person or team who will manage the process

9.3. Identify Hazards, Assess Risk and Determine Needs

- Identify work activities requiring a work permit and the type of permit needed. One way is to do a job hazard analysis of all critical tasks.
- Review legislative requirements, codes and standards, and industry practices.
- Assess risks based on severity of th hazards and numbers of people exposed, and prioritize work permit needs based on this assessment.
- Identify the resources needed to set up and maintain the system.

9.4. Communicate the Policy and Procedures

When you have finalized your policy and procedures, ensure that they are communicated to all employees and others affected, e.g., contractors.

- **Provide Training**

No matter how well designed your work permit system is, it will only succeed if your staff understand how to comply with it.

Identify all employees who need training and the training content. Provide training, preferably as a group, to all possible users and staff involved in the system.

Provide training before new technology or processes are used. Follow up with periodic refresher training to cover experiences with the permit system, suggestions for improvement and staff changes.

- **Measure and Evaluate**

It is important to monitor and evaluate your work permit system to ensure that it is being followed correctly and that it is effective.

Include your work permit procedures as part of your workplace inspections. Also consult your staff on the effectiveness of the system and consider their suggestions on how to improve it.

Review your work permit system at least every six months. This will involve, for example, an evaluation of the results of:

- in-plant spot checks that work permits are being used and complied with properly
- tests to establish a person's competence to qualify as authorized signer
- review of completed work permit forms
- detailed investigation and analysis of all incidents involving work permits.

CONCLUSION

To conclude, it is clear that the application of computers to the problems of PTW systems promises a variety of benefits ranging from adding legibility to the proactive retrieval of information appropriate to the user' s situation but which he has not actually asked for. Collectively, these enhancements promise to make PTWs far more effective. Hopefully this should go a long way towards improving plant safety as well as improving business efficiency in the chemical industrial workplace. It is unlikely, however, that any system will be able to render maintenance actually *safe*: the HSE has noted that in many cases, workers have failed to do what their permits correctly told them they should, either considering the completion of a permit as an end in itself unrelated to actual work practice, or for some other reason. Computerizing the process is unlikely to change this singularly human pattern of behaviour.

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