OVERVIEW OF INDIAN HAZARDOUS LOCATION SYSTEM

By B K Gupta
Ex-Protecta/ TECEX Foundation
B 709, Punit Tower No1,
Plot 31, Sector 11, CBD Belapur,
Navi Mumbai 400 614 INDIA
bkgupta5@gmail.com/ bkgupta10@sify.com/ tecex@tecexfoundation.org

***Abstract* –** Petroleum, Chemical & many Industries has presence of flammable liquids, gases, vapours, combustible dust, flying & fibers. Underground coal mines have presence of Firedamp (a naturally occurring mixture of hydrocarbon gases) & combustible coal dust. Open cast coal mines have presence of combustible coal dust. These flammable substances in combination of ambient air form flammable mixture. The area containing such flammable mixture is known as hazardous area. An arc, spark or hot surfaces of equipments can lead to explosion of flammable media causing damages to plant, mines & operating personnel. In serious instances it may lead to consequential damages to surrounding property & population also. To prevent such explosion various safety measures are taken, use of explosion protected (Ex) Electrical & Electronic Equipments is one of these.

There are several aspect related to locations having hazardous area & Ex Equipments. This paper is being presented to project overview of Hazardous Location system as prevailing at present in India. Following are the various parts of this system which are discussed in this paper.

- **Product Code**
- **Product Testing & Certification**
- **Product Conformity Assurance**
- **Statutory Acts & Rules**
- **Product selection, Installation & maintenance**
- **Safety Audit**
- **Interface Issues**

Index Terms – Indian Hazloc System, Code, Testing & certification, Conformity Assessment, Acts & Rules.

I. PRODUCT CODE

Bureau of Indian Standards (BIS) is the National code laying body in India. The role of Indian Standards (formulated by BIS) in Indian Hazardous location system is to cover all aspects relating to Area Classification, equipment construction, testing, selection, installation, inspection, maintenance, repair & overhaul of Ex equipments. IEC is the international body for code laying. CENELEC takes up this role in Europe. Situation is slightly different in USA, where NEC comes out with code for installation requirements & product codes are formulated by organisation like UL, ISA & ANSI. Wide part of world including India accepts these international codes for Ex Equipments of imported origin.

In this era of globalization, with removal of negative list for import of items, no non-tariff barrier is possible under GATT regime & Indian Industry has to be ready for global competition. Relevance of small-scale industry is lost, as they have to compete with global players having mass production base. Only option left for Indian industry is to produce world-class goods conforming to International standards & compete with global players not only on home turf but in International Market also. How this can be achieved. Key lies with adoption of international standards (IEC) and international conformity assessment schemes (IECEx).

Let us see, what IEC says about importance of International Standards. It says, “IEC’s International Standards facilitate world trade by, effectively, removing technical barriers to trade, leading to new markets and economic growth. Put simply, a component or system manufactured to IEC standards and manufactured in country A can be sold & used in countries B through Z.”. EU countries have adopted CENELEC codes, which are identical to IEC as CENELEC & IEC have cooperation agreement for harmonization of standards.

In view of this adoption of IEC Codes as Indian Standards becomes prerequisite for creating a level playing field for Indian manufacturers vis a vis international manufacturers. At present, various BIS codes pertaining to Ex equipments are being harmonized with IEC Codes as discussed later in this paper. However, some codes

like selection & installation of Ex equipments are being adopted with lot of modification as Indian Standards, putting Indian manufacturers & users of Ex equipments at dis-advantage vis-à-vis International manufacturers & users. Prominent example being IEC permits use of Increased Safety equipments in Group II Zone 1 locations whereas BIS code does not permit this & restricts its use in Group II Zone 2 only. This stipulation covers major Ex equipments like luminaries, motors & terminal housing. This stipulation leads to additional cost to users due to use of Ex d equipments in place of Ex e equipments in Zone 1.

BIS as representative of INDIA is a participating member to IEC Committee no TC31 responsible for preparation of IEC codes for Ex equipments. It is essential that remaining Indian Standards pertaining to Ex equipments & related aspect be aligned with relevant IEC codes by adopting identical codes to IEC as above. This would ensure acceptability of Indian products at par with international products & shall also remove above cited disadvantage to Indian manufacturers.

However adoption of IEC codes is taking a long time due to procedural formalities of circulation of draft codes for comments and approval in ET 22(counterpart of TC31 at national level) meeting, which is held with long gap of around one year. Situation has improved of late but still needs to be accelerated. BIS have practically no codes for areas having combustible dusts. This is very serious looking to number of plants having such locations. IEC has 10 codes (Series 61241). Similarly IEC has six codes for Gas detection in HAZLOC area. All these codes need to be adopted.

There is no logic in the said procedure as IEC codes are to be adopted without any change for bringing Indian Standards at par with IEC codes. It will be appropriate to reprint all the IEC codes as Indian standards without loss of time. It is illogical to review IEC codes after adoption by IEC as it has already been scrutinized, commented, discussed & adopted with full consent of BIS. The role of ET 22 should be to review draft IEC codes before it is voted at IEC. The BIS should represent the recommendation of ET 22 regarding draft IEC codes in IEC for discussion & adoption. Once the IEC code is revised & adopted, it should be adopted as Indian Standard (without any change) thus bringing Indian Standards at par with International Standards.

A list of prevailing IS codes & IEC codes are enclosed in Annexure A. As may be seen all nine IEC codes of 60079 series pertaining to Ex equipments for explosive atmosphere formed by gases & vapours have already been adopted as Indian Standard. These Indian Standards are already implemented w.e.f. 1 Jan 2008 except for Ex d, which has been implemented w.e.f. 31 March 2008. Thus Indian products are at par with International products as far as standards are concerned. However, other IEC codes are under various stage of adoption.

II. PRODUCT TESTING & CERTIFICATION

Central Institute of Mining & Fuel Research (CIMFR), Dhanbad, Central Power Research Institute (CPRI), Bangalore & Electronics Regional Testing Lab (ERTL), Kolkata has product testing & certification facilities for Ex equipments in INDIA. UL, FM, Intertek & others in USA, CSA in Canada and BASEEFA, SIRA, PTB, DNV and many more agencies in Europe have testing & certification facility.

IEC gives recognition to Ex Testing Laboratories (ExTL) for testing & certification of Ex equipments under IECEx scheme. This scheme will be dealt in more detail under next heading of product conformity assurance.

It is essential that all the above test labs (CIMFR, CPRI & ERTL) get the recognition from IEC as ExTL under IECEx scheme, so that products tested & certified by them will have International acceptability.

III. PRODUCT CONFORMITY ASSURANCE

BIS is entrusted with powers to license manufacturers for Quality Mark for Ex equipments and is governed by provisions of the Bureau of Indian Standards Act 1986. However only Ex d, Ex e and Ex i equipments are covered under Quality mark and other type of Ex equipments are not covered under Quality mark scheme by BIS.

The aim of ISO 9000 QMS certification is to make products & services acceptable in all countries on the basis of a single assessment & approval in any one country. ISO 9000 QMS certification creates confidence

among potential customers that certified manufacturer could meet their quality requirements. ISO 9000 QMS certification being internationally recognized, the certified firm's product quality has word-wide acceptance. Products manufactured by Indian manufacturers conforming to International Standards under ISO 9000 Quality Management System Certification shall make their products acceptable in International Market. ISO 9000 QMS certification supplemented with EN 13980 is being used for quality control of Ex equipments in EU under ATEX directive. ISO 9000 along with OD 005 (same as EN 13980) is used for quality control under IECEx scheme.

Scheme of Testing & Inspection of flameproof enclosures of electrical apparatus according to IS 2148 (Document No STI/2148/7 Nov 2003) with reference to quality control states that efforts should be made to gradually introduce a quality management system in accordance with IS/ ISO 9000 series as appropriate to the activities of the organization.

ISO 9000 QMS certification supplemented by ODO 005 (EN 13980) should be given preference over BIS Mark as they have word wide recognition & secondly it covers full range of Ex equipments conforming to Indian & International Standards, whereas BIS mark covers only Ex d & Exi type of Ex equipments conforming to Indian Standard. IFMA has taken up matter of combined licence based on this basis & is eagerly awaiting its implementation.

Manufacturers in USA are normally having UL mark. UL is an independent body framing product standards, testing & certifying product to these codes and allow manufacturer to use UL mark and ensure conformity assurance by way of surveillance.

Manufacturers in Europe have CE mark as conformity assurance. CE mark has become mandatory w.e.f. 1 July 2003 in EU. CE marking is manufacturers claim that the product meets the requirement of EU directives. ISO 9000 QMS certification (supplemented by EN 13980) from notified bodies is one of the options for production control under ATEX directive to achieve CE marking.

CIMFR, CPRI & ERTL should also start Conformity Assurance Programme based on ISO 9000 supplemented by OD 005 as a transitional measure till IECEx is implemented in India. With setting up of Quality Council of India, India now has its own accreditation agency (NABCB), which is recognized world over. Accreditation from NABCB for such services is possible & can be utilized by these certification agencies. Certification bodies like STQC, CEIL, UL, DNV may also start such schemes.

IEC facilitates the IECEx certification scheme for Ex equipments. The objective of the scheme is use of one international certificate & mark accepted by all participating countries. It gives recognition to Accepted Certification Bodies (ACB) who controls use of IECEx mark by manufacturers.

For adoption of IECEx, it will be necessary for CIMFR, CPRI & ERTL to take steps to become ExTL as brought out in earlier para as also ACB. Internationally there is concept of segregation of Code laying & Conformity Assurance body e.g. in UK, BSI is code-laying body and SIRA Certification services & others are ExTL & ACB. Similarly in India BIS is code laying body & CIMFR, CPRI & ERTL should become ExTL & ACB.

In view of above, the manufacturer should have option for BIS mark or ISO 9000 QMS certification supplemented with OD 005 for Product conformity assurance immediately & option of IECEx, when implemented. This step will ensure International acceptability of Indian manufactured Ex equipments.

India has now become member country of IECEx through BIS as nodal agency. Matter of combined licence is also under active consideration of BIS. BIS has already implemented concurrent running of old & New version of IS codes during transit period under BIS mark scheme. Chief controller of Explosives has favorably considered scheme of conformity assurance based on ISO 9000 supplemented by OD 005. A task force has been constituted to frame guidelines for implementation.

IV. STATUTORY ACTS & RULES

A. *Factories Act 1948*
Statutory Authority: Director General of Factory Advice & Labour Institute, Mumbai

Installation of Ex equipments in Factories is governed by Factories Act 1948. Chief Inspector of Factories is a statutory authority entrusted to enforce this Act. However, DGFASLI is granting product approval for Ex equipments, although there is no such provision in Factories Act.

In view of several difficulties faced for product approval from DGFASLI, non-cooperation of them regarding simplification of product approval despite representation by Industry association (IFMA) & in view of the fact that they do not have any power for product approval under Factories Act, 1948, all the manufacturers have stopped applying to DGFASLI for product approval w.e.f. July'2001.

B. *The Petroleum Act 1934 & The Petroleum Rules 2002*
Statutory Authority: Chief Controller of Explosives, Nagpur

Installation of Ex equipments in areas producing, refining, blending, storage of petroleum is governed by The Petroleum act 1934 & Petroleum Rules 2002. Chief Controller of Explosives (CCOE) is statutory authority entrusted to enforce these acts & rules.

The Petroleum Rules 2002 stipulates types of Ex equipments, which can be used in Hazardous areas with approval of CCOE in writing (Refer rule 106). The approval has been further elaborated as " Where applied to an appliance or fitting bears a label of a designated test organization certifying conformity with a specification approved by the Chief Controller or with a laboratory test report accepted by the Chief Controller" (Refer rule 2). The essence of the rule is that for Indian Manufacturer the approval shall be granted based on Test report, of CIMFR & such other Test organization, which are approved by CCOE, certifying product to be in conformity with BIS Codes, or such other specification approved by CCOE. For Foreign manufacturer it means that approval shall be granted based on Test report, of such Test organizations, which are approved by CCOE, certifying product to be in conformity with such specification approved by CCOE.

In view of above, the CCOE approval of Ex equipments should be automatic for products having certificate in conformity to Standards (A list may be circulated by CCOE, this may include BIS/ IEC / EN / UL/ ISA for both Indian & foreign Manufacturers) from Test organization (A list may be circulated, this may include CIMFR, CPRI, ERTL & any lab in India approved by NABL and foreign labs like SIRA, PTB, UL & FM etc).

However, at present product approval for Ex d equipments are granted by CCOE based on Test certificate & BIS License. For other type of Ex equipments, CCOE grants approval based on test certificate.

As Indian Standards is already available for selection & use of Ex equipments in all types of Hazardous location, the rules should refer to concerned Indian Standard for selection of Ex equipments. As far as check on quality is concerned CCOE can specify that Ex equipments shall be BIS or IECEx Marked or produced by manufacturer under ISO 9000 QMS certification supplemented by OD 005 under surveillance of Certification agencies to be notified by PESO.

C. *The Coal Mines Regulation 1957 & Oil Mines Regulation 1984*
Statutory Authority: Director General of Mines Safety, Dhanbad

Under coalmines regulations 1957, it is specified "In every gassy seam of the second or third degree, only flameproof electrical apparatus & equipments shall be used below ground unless otherwise provided for under the Indian Electricity Rules, 1956." This rule was inserted by GSR 32 Dated 14.12.1978. (Refer rule 181-2)

Under the Oil Mines Regulations, 1984 (Rule 75-2) Chief Inspector of Mines has been empowered to grant product approval for Ex equipments to be used in Zone 1 & 2.

DGMS is granting approval for field-testing & after successful testing & receipt of field trial report from users is granting product approval. Group II apparatus of various manufacturers are operating satisfactorily in

Installation under CCOE jurisdiction. The performance certificate of it should be acceptable to DGMS for granting approval under Oil Mines regulation. As Plant & installations are of similar nature, there is only difference in Statutory Authority.

As Indian Standard is already available for selection & use of Ex equipments in all types of Hazardous location, the rules should refer to concerned Indian Standards for selection of Ex equipments. As far as check on quality is concerned DGMS can specify that Ex equipments shall be BIS or IEC Ex Marked or produced by manufacturer under ISO 9000 QMS certification supplemented by OD 005 under surveillance of Certification agencies to be notified by DGMS.

V. PRODUCT INSTALLATION & MAINTENANCE

Users are dependent on consultants to a large extent for implementation of new projects or major expansion & modification. They rely on their in-house expertise for maintenance needs. BIS has already issued guides/ codes of practice for selection, installation & maintenance of Ex equipments as under:

IS 9559-1980: Guide for selection of electrical & electronic equipments for coalmines
IS 4051-1967: Code of practice for installation & maintenance of electrical equipments in mines.
IS 13408 (Part 1)- 1992: Code of practice for selection, installation & maintenance of electrical apparatus for use in potentially explosive atmospheres (other than mining application or explosives processing & manufacture)

Above codes are under revision based on IEC & other international codes. However these codes will still have some national differences based on Petroleum Rules & Oil Mines regulation. Statutory authorities need to look into these differences & try to remove these difference based on technological advances taking place.

Approval of installation of Ex equipment from statutory authority i.e. DGFASLI, CCOE & DGMS is a major task for the users. Comprehensive guidelines laying down all the requirement & procedures in respect of all the statutory authorities for approval of installation of Ex equipments, recommended practice for safety audit of Ex equipment by third party inspection agencies needs to be issued by BIS in consultation with user industries, statutory authorities, third party inspection agencies & manufacturers.

Statutory authorities should grant approval based on report of inspection & recommendation for approval of installation from third party inspection agencies having ISO 9000 accreditation for rendering such services. This will promote self-regulation by Industry & expedite statutory approvals.

VI. INTERFACE ISSUES

During ET 22 meeting held on 20.3.2002, due to procedural constrains no points other than code laying was discussed. A co-ordination meeting convened by CIMFR having representatives from Statutory authorities, BIS, Testing Labs, Consultants, Users & manufacturers to discuss various interface issues was held on 26.7.2002. All the interface issues related with Codes, Type examination, Conformity assessment & Statutory approvals were discussed threadbare. There was a consensus to form a co-ordination committee having representation from statutory authorities, BIS, Testing Labs, Consultants, Users & Manufacturers with CIMFR as convener to hold meetings regularly to sort out interface issues. However there is no further progress in the matter. In absence of such committee various interface issues are taking lot of time for resolution. However it is noted that of late concerned authorities have taken note of these issues & a number of issues have been sorted out.

VII. CONCLUSION

Product Codes

IEC Codes should be reprinted as Indian Standards (IS/IEC).
Role of ET 22 should be to examine & comment on draft IEC codes. BIS in TC 31 of IEC should represent these comments.

Product Testing & Certification

Indian Test Labs (CIMFR, CPRI, ERTL) should become ExTL under IECEx scheme.

Product Conformity Assessment

Conformity scheme based on ISO 9000 & supplemented by OD 005 by third party certifiers notified by statutory authorities should be accepted for product conformity assessment.
Indian Labs should implement conformity assessment scheme based on ISO 9000 supplemented by OD 005.
Indian Labs should implement IECEx by becoming ExTL & ACB.

Acts & Rules
DGFASLI

DGFASLI should confirm to Industries Association (IFMA) that they do not have power for product approval.

DGMS

Oil Mines Regulations 1984 & Coal Mines Regulations 1957 should be amended to stipulate that Indian Standards should be referred for selection & use of Ex equipments thus dispensing with product approval.

Till this amendment is effected, DGMS should give approval based on CIMFR certificate plus conformity assessment system (Option to manufacturers: Any one of these – Conformity assessment by third party certifiers/ labs notified by DGMS based on ISO 9000 supplemented by OD 005, BIS Mark, IECEx)

CCOE

Petroleum Rules 2002 should be amended to stipulate that Indian Standards should be referred for selection & use of Ex equipments thus dispensing with product approval.

Till this amendment is effected, CCOE should give approval based on CIMFR certificate plus conformity assessment system (Option to manufacturers: Any one of these – Conformity assessment by third party certifiers/ labs notified by CCOE based on ISO 9000 supplemented by OD 005, BIS Mark, IECEx)

Product Installation & maintenance

Recommended code of practice for installation, maintenance and safety audit of Ex equipments needs to be strengthened.

Guidelines for statutory approval of Installations needs to be streamlined & third party certifiers need to be given due role in this to obtain self regulation.

Interface Issues

The co-ordination committee to be formed for resolving interface issues needs to be supported by Statutory authorities, BIS, Testing Labs, Consultants, Users, Manufacturer & Third Party certifiers by active participation & acceptance / implementation of its recommendations for benefit of all.

VIII. APPENDICES

A list of prevailing IS codes & IEC codes are enclosed in Annexure A.

IX. REFERENCES

Information for compiling this paper has been drawn from official web site & information circulars of various organisations. Author has quoted the reference where ever possible. The links of websites are as follows for interested persons for additional information.

ISO- http://www.iso.ch
IEC- http://www.iec.ch
CENELEC- http://cenelec.org
UL-http://www.ul.com
BSI-http://www.bsi-global.com
Quality Council of India- http://qcin.org
BIS-http://www.bis.org.in

X. VITA

The author is engineering graduate in electrical from Maulana Azad College of Technology, Bhopal, passed in year 1977 with distinction. He served for around 3 years in Orient Paper Mills, Brajrajnagar (Orissa) as Electrical engineer in various process plants & electrical workshop. Assignment gave him good exposure of maintenance, capital repairs & revamping of electrical installation of plant. Thereafter, he was employed with Oil & Natural Gas Corporation Ltd for around 14 Years. This phase of his employment gave him ample exposure to Planning & execution of large projects of international level both onshore & offshore involving great deal of detailing & strategic planning. He visited Oil fields in Canada, Steel Mill in Italy & fabrication yard of Samsung, South Korea during his work assignment.

Since last fourteen years, he is concentrating in field of Ex equipments. He is now actively involved with M/s Ex-Protecta, a leading Ex equipment manufacturers, looking after their design, development, certification & quality audit of Ex equipments & systems. He also looks after Mumbai office of Ex-Protecta for marketing, after sales & other allied responsibilities.

Technical matters are subject in which he is deeply interested. This has motivated him to render services as consultant to IFMA, President, ISA-Patalganga Section & as member of ET 22 & ET 24 of Bureau of Indian Standards. ET 22 of BIS is responsible for laying of standards related to Ex equipments while ET 24 lays down standards for Light fittings. He is also associated with TECEX foundation as honorary Technical Advisor. He has compiled & conducts Ex Protection Course for Maritime Electrical Engineers as visiting faculty to International Maritime Training Centre, MUMBAI.

He was instrumental in holding international event fashioned as TECEX as under

TECEX 2003 (Seminar & Concurrent Exhibition related with all aspects of ex equipments) on 4th & 5th Dec 2003 at CIMFR, Dhanbad &

TECEX 2005 (Seminar & Concurrent Exhibition related with all aspects of ex equipments) on 20th & 21th Dec 2005 at Vadodara.

Published many papers in leading periodicals & journals.
Presented many papers in various seminars of national & international level.
Edited Proceedings-TECEX 2003 –Seminar on all aspects of Ex Equipments (ISBN 81-900896-0-9).
Edited Souvenir-TECEX 2005 –Seminar on all expects of Ex Equipments

He can be contacted on Tel 91-22-27579071 & 91-22-27575832
Email id bkgupta5@gmail.com; bkgupta10@sify.com; tecexfoundation@yahoo.co.in