

EVOLUTION OF INDUSTRIAL SAFETY REGULATION

Early Days

The Factories Act, 1948 lays down the provisions of industrial safety requirements in factories. The responsibility for implementation of this Act lies with the State Government. However, by virtue of the Atomic Energy Act, 1962, the responsibility for administration of the Factories Act in DAE units has been vested in the Central Government. Prior to formation of AERB, industrial safety aspects of DAE facilities were looked after by Industrial Hygiene and Safety Section (IHSS) of Health Physics Division, BARC. IHSS advised various plants on industrial hygiene and safety aspects of the design and operations. It also carried out measurements of toxic pollutants and surveyed noise and illumination levels in the working environment. It investigated industrial accidents and brought out periodic reports on industrial safety aspects of DAE facilities. The Inspection Section (Factories Act) of BARC used to enforce the provisions of the Factories Act, 1948 in the units of DAE. These sections provided the inputs to the Safety Review Committee of DAE (DAE-SRC) which had the responsibility for overseeing the safety of DAE units. However, when AERB was constituted in 1983, AERB was mandated to administer the provisions of the Factories Act, 1948 in all DAE units. Atomic Energy (Factories) Rules were first published in 1984 based on the Factories Act.

Industrial Safety Regulation (1983 – 2000)

Committees to review the Industrial Safety Status

Within few years of its formation, AERB constituted a committee in 1985 for Review of Industrial Safety Status in Department of Atomic Energy Units (RISSDAEU Committee) with M.S.R. Sarma, the then Director, Nuclear and Industrial Safety Division, AERB as Chairman. The committee held meetings with DAE organizations

and visited some of them. The recommendations of the committee were categorized as 'General', which were applicable to all units and 'Specific', which related to the facility concerned. The 'General' recommendations pertained to safety management which included safety policy, safety organization, cadre of safety, awareness and understanding statutory requirements, development of safety culture, safety training requirements, emergency plans, etc. The 'Specific' recommendations related to issues specific to plants such as augmentation of ventilation (NFC & IRE), correction of certain design deficiencies (HWPK, NFC, NAPP), management of H₂S problems (HWPK), etc.

In 1988, AERB constituted another Committee to Review the Industrial Safety Status in R&D units of DAE with H.N. Kaul, the then Executive Director, HWB as Chairman. The recommendations mainly pertained to applicability and compliance with provisions of statutory acts & rules like Factories Act, 1948, Atomic Energy (Factories) Rules, 1984 to R& D units. The major recommendations were related to safety policy, safety organization, assurance of safety, emergency planning, accident investigation & analysis, occupational health, etc.

Fire Safety Study Committee

The Committee for Fire Safety Study was appointed by Chairman, AEC in February 1991 under the Chairmanship of G.R. Balasubramanian consisting of experts in this field from AERB/DAE and non-DAE units. The committee was appointed to identify major fire hazards, requirement or availability of fire protection system and the consequences of fire in DAE installations. The committee visited all the twenty three nuclear installations and made recommendations for improvement of fire safety for each unit. This committee was later renamed and reconstituted by Chairman, AERB as Advisory Committee on Fire Safety (ACFS) with S. Sen and later N.K. Agrawal as Chairman.

Regulatory activities related to industrial safety

In June 1987, DAE-SRC was renamed as Safety Review Committee for Operating Plants (SARCOP) and AERB designated four major divisions which included Industrial Safety Division (ISD) led by D.K. Dave and was entrusted with the responsibility for ensuring industrial safety in DAE units. From 1990 this division was headed by P.K. Ghosh. Through this division AERB started issuing formal licenses to operating personnel of HWPs after reviewing their qualification, experience and training. AERB started issuing approval to Competent Persons under the Factories Act and issuing of licenses to the industrial units of DAE under the Factories Act. AERB also designated Competent Persons under the relevant sections of the Factories Act for civil construction and structural works, operation of dangerous machines, lifts and hoists, lifting machinery, lifting tackles, pressure plant, dangerous fumes, supervision of handling of hazardous substances and ventilation system.

In January 1994, ISD was reconstituted as Industrial and Radiation Safety Division (IRSD) as a part of the Directorate of Regulatory Inspection and Enforcement (DRI&E). This division now handled the operating industrial units of DAE and their projects as well as the non-DAE activities involving radioactive sources and radiation generating equipment. In 1994, the responsibility for regulatory inspection and enforcement of Factories Act and the Atomic Energy (Factories) Rules, 1984 in DAE units was also transferred from Inspection Section (Factories Act) of BARC to IRSD and subsequently this section was merged with IRSD of AERB.

Review of the Atomic Energy (Factories) Rules, 1984

Amendments were made in 1987 to the Factories Act, 1948 as a sequel to Bhopal gas disaster. AERB had also received significant feedback from the operational experience of implementation of Atomic Energy (Factories) Rules, 1984 in DAE units. In the light of these as well as recommendations made earlier by RISSDAEU Committee, it

was felt necessary to amend the existing Atomic Energy (Factories) Rules. A committee consisting of experts from BARC, DGFASLI and AERB was entrusted the responsibility to review the Atomic Energy (Factories) Rules, 1984 and propose the amendments. The amended rules after review in AERB and vetting by various ministries of Government of India were published in the Gazette of India as Atomic Energy (Factories) Rules, 1996. In 1996, Chairman AERB for the first time designated some of the senior officers of AERB as inspectors under the Factories Act, 1948.

Industrial Safety Regulation (2000 -2008)

Following an organizational restructuring in AERB in 2000, IRSD was renamed as Industrial Plants Safety Division (IPSD). The regulatory inspections for enforcement of the Atomic Energy (Factories) Rules, 1996 are now being carried out by IPSD for all nuclear fuel cycle facilities including nuclear power plants and projects and DAE accelerator facilities.

To bring industrial safety structure at par with that of nuclear and radiation safety, the Board reconstituted the ACFS as the Advisory Committee on Industrial and Fire Safety (ACIFS) in May 2005 with H. N. Mirashi, former Director, DISH, Govt. of Maharashtra as the Chairman in line with Advisory Committee on Nuclear Safety (ACNS) and Advisory Committee on Radiation Safety (ACRS). The scope of ACIFS was now extended to include the industrial safety aspects also. In September 2008, S. K. Mukherjee, Former, Executive Director (HSE), HPCL, Mumbai took over as the Chairman of the Committee. ACIFS advises AERB on generic industrial and fire safety issues, recommends measures on industrial safety aspects for prevention of accidents at all DAE installations including projects under construction, provides guidance on the overall planning for fire prevention, detection and protection at all DAE installations, conducts final review of the safety documents being developed by AERB on industrial and fire safety and advises on preparation of new documents and revision of existing ones on the subject.

The industrial safety aspects of uranium and thorium mines were being enforced by both Directorate General of Mines Safety (DGMS) and AERB. Based on a decision by DAE and AERB to remove this dual regulation, Chairman AERB issued an office order in October 2005. As per this order, Industrial Safety in mines of DAE (where Factories Act is not applicable) would be solely under the purview of DGMS under the Mines Act.

Industrial and Fire Safety Review

IPSD prepared a checklist for Fire Safety Audit and based on this checklist AERB directed all DAE units to carry out Fire Safety Audit which is a detailed study and assessment of the fire prevention programme. The audit is required to be carried out by persons independent of the plant and the review is to be focussed on site specific requirement, depending on the hazard potential of plant operation.

During life extension review of TAPS-1&2 and MAPS, AERB carried out a detailed study on the upgradation of the fire protection systems to meet the current standards. The recommendations of the study were implemented. These studies formed the basis of fire hazard analysis for all fuel cycle facilities and formed a regulatory requirement for the consenting process. Guidelines for conducting fire hazard analysis have been incorporated in the AERB Standard for Fire Protection in Nuclear Facilities. Over the years AERB has enhanced its risk assessment capability by application of the state of the art softwares like FDS, COMPBRN-IIIe etc for fire hazard analysis and PHAST, ALOHA, SAVE-II, EFFECTS etc for chemical consequence and risk analysis. IPSD carried out fire risk assessment study for Heavy Water Plants and several hazard identification studies and consequence analysis for projects and operating units with respect to hazard potential.

IPSD regularly reviews the tri-annual Safety, Health and Environment (SHE) reports containing information on injury statistics,

fire occurrences, environmental releases etc. Safety Related Unusual Occurrences Reports (SRUOR) related to Fire and Industrial Safety events are subjected to three-tier review, namely, the Plant Safety Committee, Unit Safety Committees and SARCOP.

Occupational Health Safety Review

AERB constituted an Advisory Committee on Occupational Health (ACOH) to advise it on occupational health aspects including implementation of statutory provisions, occupational disease etc. Usha Desai was the founder Chairman of this committee. B.J.Shankar and P.T.V.Nair, former Heads, Medical Division, BARC subsequently chaired the committee. Yearly status reports on occupational health and industrial hygiene of DAE units are reviewed by this Committee. Approval of Certifying Surgeons in the units of DAE was also started from the year 1998 as per the requirements under the Factories Act and The Atomic Energy (Factories) Rules, 1996.

Fatal Accident Assessment

AERB constituted a Fatal Accident Assessment Committee [FAAC] to assess fatal accidents in DAE units and to arrive at the root causes of accident and preventive actions to be taken to avoid recurrence. Due to concern over the increase in fatal accidents at the Construction Sites of DAE, AERB issued in July 2002 the notification on "Industrial Safety Personnel at Construction Sites" which stipulates the minimum requirement of safety personnel and their qualifications. AERB also organized a discussion meeting of the plant heads of DAE in July 2004. The meet focused on the job hazard analysis for different jobs/activities carried out at construction sites. Emphasis was given on strict usage of personal protective equipment, safety training to the workers, penalty clauses in tender documents, supervision of the workplace and empowerment of inspectors. To further strengthen the industrial safety in DAE units, AERB issued another notification in November 2004 on "Empowerment of Inspectors- Power to Stop Work" in case of unsafe conditions. The minimum safety requirements needed on site were specified along with this notification.

Despite these measures, fatal accidents recurrence continued at construction sites of DAE. In view of this AERB organized a meeting with all unit heads of DAE in August 2005 to discuss various pertinent issues like lack of supervision, inadequate job hazard analysis, violation of safety norms, faulty procedures, etc. Consequently, it was decided that special regulatory inspections of all construction units of DAE shall be carried out once in every month from September 2006 onwards with particular emphasis on works at heights. These monthly inspections have helped in improvement of safety culture at construction sites and betterment of safety record.

Safety Promotional Activities

Apart from the routing regulatory activities of review, inspection and development of safety documents, AERB also instituted various schemes to encourage and promote safety in the DAE units. As a step to appreciate the assiduous efforts put by the units to improve the safety standards, AERB introduced the Safety Awards scheme. It organizes the safety professionals meet every year at various DAE sites, which not only serves as a valuable platform for exchange of information and sharing of experiences but also helps in enhancing the role and importance of safety professionals in the organization. These meetings also provide a good feedback to the regulators.

Safety Professionals Meet

The first Meeting of the Safety Professionals was held way back in June 1982 at Kalpakkam under the leadership of G.R. Balasubramanian, the then Head, Reprocessing Programme at IGCAR. The meet was attended by 9 safety professionals. Subsequently, the next three meets were also held at Kalpakkam. In the 5th Meeting of Safety Professionals, held at Mumbai in September 1988, the then Chairman, SARCOF, M.S.R. Sarma informed about the report brought out by the RISSADEAU Committee. During the meeting two major decisions were taken (i) to hold workshop at the individual units to discuss statutory requirements and their implications and (ii) to conduct a

seminar on industrial safety. As a follow-up to the meet, a one-day workshop was organized with the top management of Department of Atomic Energy at OYC auditorium, Mumbai. The requirements like commitments to the provisions for safety in tender documents, safety organization at site and headquarters, safety supervision, safety review, responsibilities of management etc were discussed in great detail in the workshop.

During this workshop it was decided that one day seminar should be conducted during the Safety Officers meet to be held at various units and an attempt should be made to bring in the local authorities like Inspectorate of Factories, etc. for participation in the two days workshop. The 6th DAE Safety Professionals Meet was held at IGCAR, Kalpakkam. It was then decided that AERB should conduct the safety professionals meet every year at various units with the help of concerned units. The 7th meet was held at Kakrapar Atomic Power Station in August 1990 and for the first time, a theme was assigned to the meet. Since then, safety professionals meets are being held at different DAE units to discuss safety issues and to share information.

The 11th Safety Professionals Meet was held at NFC, Hyderabad in November 1994. This meet was preceded by one-day seminar on "Occupational Health". The meet was attended by safety professionals and doctors of various units of DAE. During this meet, all the Medical Officers met separately to discuss the "Occupational Health Programme of DAE". It was felt that the medical officers should also be aware of the various legislations relating to occupational health and it was then unequivocally decided that all Medical Officers/Certifying Surgeons shall meet every year during the DAE Safety Professionals Meet to discuss the various issues of occupational health. This meet became the forerunner for future safety and occupational health professionals meet. From 15th DAE Safety and Occupational Health Professionals

meet, AERB decided to arrange endowment lecture of experts in various field for knowledge up-gradation of the safety professionals. In the 24th meet it was announced that the future endowment lectures would be named as Ramaswamy Memorial Endowment Lecture in memory of the Late Dr. S.S. Ramaswamy, Former Member, AERB Board. A monograph on construction safety was also released during the meet.

Safety Awards

The Industrial safety award scheme, started in the year 1992, promotes industrial safety among various units of DAE. The safety performance is assessed based on computed value of Safety Numbers as per a pre-defined computational methodology. The unit having highest Safety Numbers is awarded in their respective group. The unit which had any fatality in a year is debarred from participating for Industrial Safety Award. Data are collected in standard formats every year from all the units for assessment of Safety Numbers.

The Fire Safety Award scheme was started in 1993 in order to promote fire safety among various units of DAE. The safety performance is assessed based on computed value of Preventive Efforts and Fire Hazard Index (PEFHI) as per a pre-defined computational procedure. The unit having maximum PEFHI is presented the Fire Safety Award. Data are collected in standard fire safety award data format every year from all the units for assessment of PEFHI.

The Green Site Award scheme was instituted in 1993 to promote tree plantation among various units of DAE to ensure that the atmosphere around the plant is clean and better to live in. The performance is assessed based on computed value of Greenery Index as per a pre-defined computational procedure. Data are collected in standard green site award data format every year from all the units for assessment of green site award parameters

Discussion Meetings

A one day “Workshop on Safety Legislation for Heads of the DAE Units” was arranged in AERB by IPSD on October 13, 2000. The topics such as various acts and rules, disaster management and national emergency committee, international nuclear event scale and incident reporting system, role of certifying surgeon, clarification on injury on duty leave and exemption of nuclear boilers from boiler inspection were discussed during the workshop.

A workshop on “Duties and Responsibilities of Certifying Surgeon” was conducted from March 28-29, 2001 at AERB. During the workshop, the main focus was on appointment of Certifying Surgeons in DAE units and their responsibilities in the light of the provisions of the Factories Act, 1948, Atomic Energy (Factories) Rules, 1996, Radiation Protection Rules, 1971 and Atomic Energy (Working of Mines, Minerals & Handling of Prescribed Substances) Rules, 1984.

Fire Safety Professionals Meet was organized at AERB during December 23-24, 2002. The topics such as up-gradation and modification done in operating plants, latest design provisions in the plant under design / construction, management of fire services and state of the art developments in the fire safety were covered in the meet. During the meet discussion were held on the issues such as fire prevention measures, roles and responsibilities of fire protection engineers, insights / experiences in implementing the AERB Standard for Fire Protection Systems of Nuclear Facilities.

One day discussion meet on “Enhancement of Industrial Safety in DAE Units” was organized on July 15, 2004 at AERB auditorium. The purpose of the meeting was to review the basic issue pertaining to industrial safety with special emphasis on the factors which have contributed to accidents at construction sites of DAE. The topics covered were industrial safety requirement in DAE units, overview of fatalities in DAE units, safety measures at construction sites, challenges of industrial safety at construction sites and challenges

of industrial safety at an operating plant. This was followed by discussions on specific topics related to construction activities such as job hazard analysis, need for more departmental safety supervision, use of personal protective equipment, “training for contractor workers, safety culture, work at height” and empowerment of inspectors. The conclusions arrived at after the discussions were sent to all DAE units for implementation.

In order to share the rich experience gained in the field of industrial safety and health in India, AERB organized a national symposium on Industrial and Fire Safety (SIFS) co-sponsored by Directorate General Factory Advice Service & Labour Institute (DGFASLI) of Government of India, Directorate of Industrial Safety & Health (DISH) of Government of Maharashtra and National Safety Council of India (NSCI) in November, 2006. The symposium had overwhelming response and participation with around 240 delegates from DAE units and non-DAE organizations from various parts of India.

A two-day discussion meet was jointly organized by AERB and SRI, Kalpakkam on ‘Fire Modeling’ on 20-21 September 2007 at AERB. The objective of discussion meet was to understand the current capabilities of computational tools available for fire modeling, their application to various scenarios and their validation for postulated scenarios. Delegates from DAE and Non-DAE actively participated in this discussion meet. The discussion meet focused on the topics such as Regulatory perception/requirements for Fire Hazard Analysis (FHA) of nuclear power plant facilities, computer codes for fire modeling-present predictive capabilities, CFD modeling of fires -current trends, Benchmark data for validation of fire models, Fire-Probabilistic Safety Assessment (Fire-PSA) etc.

A seminar on ‘Challenges and Innovation in Fire Safety’ along with the regular fire safety award distribution ceremony was held in April, 2008. The two-day seminar had five technical sessions on varied themes such as ‘Fire Technologies and Fire Testing Facilities’, ‘Fire

Analysis and Modeling', 'Fire Organization, Administration and Past Events', 'Fire Safety Challenges and Fire Analysis' and 'Operational Plants Fire Safety'. These sessions had invited talks of eminent experts from DRDO, HPCL, NPCIL and BARC. A monograph on fire safety was also released during the seminar.

A workshop for paramedical staff was organized in September 2008 at NFC, Hyderabad. Nearly twenty five paramedical staffs from DAE units and twenty five certifying surgeons along with ACOH members attended the workshop. There were lectures by experts from Krishna Institute of Medical Sciences, Hyderabad and St. John's Ambulance Association on acute trauma management, cardio pulmonary resuscitation with practical demonstration of resuscitation.

Workshops for competent persons were being organized earlier by NPCIL and IPSD of AERB over the years at different plant/project sites of NPCIL. The workshop for competent persons was organized for the first time by HWB at Kota in September 2008. Senior officers from AERB delivered lectures on the regulatory requirements, material handling, major hazard control in chemical industries etc.

Services rendered to other agencies

The professional expertise of IPSD in matters related to industrial and fire safety was sought time and again by various agencies other than DAE as well. For example AERB was the executing institution for IAEA Inter Agency Project on "Assessment and Management of Health and Environmental Risks from Industries in Trans Thane Creek Area" which started in 1990 in collaboration with Maharashtra Pollution Control Board, Bhabha Atomic Research Centre, Indian Institute of Technology, Mumbai and Thane Belapur Industries Association. IPSD was also involved in the IAEA Co-ordinated Research Project for comparative risk assessment for waste from different electricity generating systems.

Safety Audit, Hazard Identification and Consequence Estimation for M/s Lubrizol India Ltd was carried out in 1992-1993, Safety Audit and Consequence Analysis for the potentially hazardous industries situated in Chembur area was conducted in 1993-1994 on the request of Ministry of Environment and Forests. District wise Hazard Analysis of Major Hazardous Industries in Raigad District in Maharashtra was carried on in 1998 on the request of Ministry of Environment and Forests. IPSD carried out the review of the Safety of Underground Oil Pipelines in and around Anushaktinagar.

Bureau of Indian Standards (BIS) sought expertise of AERB for drafting of documents like the Indian Standards on “Code of Practice on Occupational Safety and Health Audit (IS 14489: 1998)”, “Code of practice on Hazard Identification and Risk Analysis (IS 15656:2006), “Code of Safety for Chemical Laboratories”, etc. AERB prepared ‘Uniform and Harmonized Risk Assessment Standard and Guidance Manual’ for the Ministry of Environment & Forests (MoEF) in 2008. Expertise of IPSD has also been sought by Government of Maharashtra for investigation of accidents in various textiles and explosive industries. IPSD, AERB has also provided necessary support to DCSEM in the formulation and review of guidelines on industrial safety in DAE township. Experts from IPSD, AERB are regularly called by DAE units, non-DAE units and other organizations like National Safety Council as invited speakers for various workshops, seminars and symposia on industrial, fire, occupational health and environmental safety.

Recent Developments

The experience and feedback gained over the years while enforcing the regulations has served as valuable inputs for further strengthening of the regulation. Based on the current amendments to the Factories Act, 1948, the review amendments to the Atomic Energy (Factories) Rules, 1996 are now being carried out. Similarly review of AERB Standard for Fire Protection Systems of Nuclear Facilities has been

undertaken to incorporate the current changes and developments in Fire Safety. Review of Safety Guide on Works Contract is being carried out in the light of the experience gained in the construction safety in various DAE units. Thus regulatory activities related to industrial and fire safety have come a long way since the inception of AERB. However, there is a constant endeavor in AERB to keep upgrading the industrial and fire safety status in DAE units.

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