ASSE Tech Brief

September 23, 2011

ANSI/ASSE Z590.3-2011

Prevention through Design
Guidelines for Addressing Occupational Hazards and Risks in Design and Redesign Processes

ASSE, as secretariat of the Z590.3 Prevention Through Design Project has continued to receive numerous inquiries related to the recent approval ANSI/ASSE Z590.3-2011 American National Standard: *Prevention Through Design: Guidelines for Addressing Occupational Hazards and Risks in Design and Redesign Processes*

Due to these inquiries for information about the standard we have put together what we call a "guide" for those with an interest. The following information below should hopefully be of assistance:

Title: ANSI/ASSE Z3590.3-2011, *Prevention Through Design: Guidelines for Addressing Occupational Hazards and Risks in Design and Redesign Processes*

Scope: This standard provides guidance on including prevention through design concepts within an occupational safety and health management system. Through the application of these concepts, decisions pertaining to occupational hazards and risks can be incorporated into the process of design and redesign of work premises, tools, equipment, machinery, substances, and work processes including their construction, manufacture, use, maintenance, and ultimate disposal or reuse. This standard provides guidance for a life-cycle assessment and design model that balances environmental and occupational safety and health goals over the life span of a facility, process, or product.

Current Status of the Standard:

Approval Date of Final Action: 9/1/2011
ANSI Standards Action Publication Date: 9/9/2011
Publication Date: October 2011
Effective Date: January 2012

The final version of the Z590.3 Table of Contents from the approved standard:

Contents SECTION ..... PAGE

Below is the text from the first four pages of the standard:

1. SCOPE, PURPOSE AND APPLICATION

1.1 Scope. This standard provides guidance on including prevention through design concepts within an occupational safety and health management system. Through the application of these concepts, decisions pertaining to occupational hazards and risks can be incorporated into the process of design and redesign of work premises, tools, equipment, machinery, substances, and work processes including their construction, manufacture, use, maintenance, and ultimate disposal or reuse. This standard provides guidance for a life-cycle assessment and design model that balances environmental and occupational safety and health goals over the life span of a facility, process, or product.

This standard complements but does not replace performance objectives existing in other specific standards and procedures.

The goals of applying prevention through design concepts in an occupational setting are to:

- Achieve acceptable risk levels.
- Prevent or reduce occupationally related injuries, illnesses, and fatalities.
- Reduce the cost of retrofitting necessary to mitigate hazards and risks that were not sufficiently addressed in the design or redesign processes.

1.2 Purpose. This standard pertains principally to the avoidance, elimination, reduction or control of occupational safety and health hazards and risks in the design and redesign process.

> Note: Incidents or exposures that have the potential to result in occupational injuries and illnesses can also result in damage to property and business interruption, and damage to the environment. Reference is made in several places in this standard to those additional loss potentials which may require evaluation and resultant action.

1.3 Application. This standard may be applied in any occupational setting. This standard applies to the four major stages of occupational risk management as follows:

1. Pre-operational stage – in the initial planning, design, specification, prototyping, and construction processes, where the opportunities are greatest and the costs are lowest for hazard and risk avoidance, elimination, reduction or control.

2. Operational stage – where hazards and risks are identified and evaluated and mitigation actions are taken through redesign initiatives or changes in work methods before incidents or exposures occur.

3. Post incident stage – where investigations are made of incidents and exposures to determine the causal factors which will lead to appropriate interventions risk levels.

4. Post operational stage – when demolition, decommissioning or reusing/rebuilding operations are undertaken.

2. REFERENCED AND RELATED STANDARDS

2.1 Referenced Standards and Guidelines.

BS OHSAS 18001/18002, *Occupational Health and Safety Management Systems – Requirements*

CSA Standard Z1000, *Occupational Health and Safety Management*

ISO 12100: *Safety of Machinery –General Principles for Design Risk assessment and risk reduction*

ISO/IEC Guide 51. *Safety aspects – Guidelines for their inclusion in standards*

MIL-STD-882D, *Standard Practice for System Safety*

SEMI S2-0706, *Environmental, Health, and Safety Guideline for Semiconductor Manufacturing Equipment*

SEMI S10-0307, *Safety Guideline for Risk Assessment and Risk Evaluation Process*

2.2 Referenced American National Standards and Technical Reports.

ANSI/AIHA Z10, *Occupational Health and Safety Management Systems*

ANSI/ASSE Z244.1, *Control of Hazardous Energy: Lockout/Tagout and Alternative Methods*

ANSI-GEIA STD-0010, *Standard Best Practice for System Safety Program Development and Execution*

ANSI/PMMI B155.1, *Safety Requirements for Packaging Machinery and Packaging-Related Converting Machinery*

ANSI/RIA R15.06, *Industrial Robots and Robot Systems – Safety Requirements*

ANSI B11.0 Safety of Machinery - *General Safety Requirements and Risk Assessment*

ANSI B11.TR7 *ANSI Technical Report for Machines – A Guide on integrating safety and lean manufacturing principles in the use of machinery*

ANSI-ITAA GEIA STD-0010, *Standard Best Practices for System Safety Program Development and Execution*

3. DEFINITIONS

3.1 Acceptable Risk. That risk for which the probability of an incident or exposure occurring and the severity of harm or damage that may result are as low as reasonably practicable (ALARP) in the setting being considered.

Note: See 7.13.1 for appropriate management decision levels.

3.2 As Low As Reasonably Practicable (ALARP). That level of risk which can be further lowered only by an increase in resource expenditure that is disproportionate in relation to the resulting decrease in risk.

3.3 Design. The process of converting an idea or market need into the detailed information from which a product, process, or technical system can be produced.

3.4 Dose Response Evaluation. Shows the relationship between the dose of a contaminant and the anticipated incidence of an adverse health or environmental effect in an exposed population.

3.5 Exposure Assessment. For occupational health and environmental purposes, exposure assessment is the multi-disciplinary field that identifies and characterizes workplace exposures, develops estimates of exposure-response and makes risk assessment studies, and evaluates the significance of exposures and effectiveness of intervention strategies.

3.6 Hazard. The potential for harm.

Note: Hazards include all aspects of technology and activity that produce risk. Hazards include the characteristics of things (e.g., equipment, technology, processes, dusts, fibers, gases, materials, and chemicals) and the actions or inactions of people.

3.7 Hazard Analysis. A process that commences with the identification of a hazard or hazards and proceeds into an estimate of the severity of harm or damage that could result if the potential of an incident or exposure occurs.

3.8 Hierarchy of Controls. A systematic approach to avoiding, eliminating, controlling, and reducing risks, considering steps in a ranked and sequential order, beginning with avoidance, elimination, and substitution. Residual risks are controlled using engineering controls, warning systems, administrative controls, and personal protective equipment.

3.9 Lifecycle. The phases of design, construction, operation, maintenance, and disposal for a facility, equipment, process, and material.

3.10 Occupational Exposure Limit (OEL). The generic term applied to the amount of a chemical, physical, or biological agent to which a worker can be exposed for a period of time, below which it is believed health is not impaired. OELs for air contaminants and noise are expressed as full shift time-weighted average values (8, 10, 12 hours, etc.), short-term exposure limits (STELs), Excursion Limits and Ceiling limits (C). Biological OELs are available for some chemicals and are employed where the main route of exposure is skin absorption and/ or inadvertent ingestion. OELs for ionizing radiation are generally expressed as a cumulative dose. Specific terms and values are established by 1) governmental regulatory agencies, 2) authoritative organizations, 3) internal company limits, or 4) working limits or guidelines.

3.11 Organization. A public or private company, corporation, firm, enterprise, government agency, non-governmental organizations, authority, or institution, or part or combination thereof, whether incorporated or not, that has its own management functions. This can consist of one or many sites or facilities.

3.12 Prevention through Design. Addressing occupational safety and health needs in the design and redesign process to prevent or minimize the work-related hazards and risks associated with the construction, manufacture, use, maintenance, retrofitting, and disposal of facilities, processes, materials, and equipment.

3.13 Probability. An estimate of the likelihood of an incident or exposure occurring that could result in harm or damage for a selected unit of time, events, population, items or activity being considered.

3.14 Process. A series of progressive and interrelated steps by which an end is attained; continuous action, operation, or a series of changes taking place in a definite manner; the action of going forward.

3.15 Reasonably Foreseeable Misuse. The predictable use of facilities, equipment, or materials in a way not intended in the original design.

3.16 Redesign. A design activity that includes all retrofitting and altering activities affecting existing facilities, equipment, technologies, materials, and processes, and the work methods.

3.17 Residual Risk. The risk remaining after risk reduction measures have been taken.

3.18 Risk. An estimate of the probability of a hazard-related incident or exposure occurring and the severity of harm or damage that could result.

3.19 Risk Assessment. A process that commences with hazard identification and analysis, through which the probable severity of harm or damage is established, followed by an estimate of the probability of the incident or exposure occurring, and concluding with a statement of risk (see Section 7).

3.20 Safety. Freedom from unacceptable risk.

3.21 Severity. An estimate of the magnitude of harm or damage that could reasonably result from a hazard-related incident or exposure.

3.22 Supplier. Any entity that provides or makes available equipment, material, or professional services.

3.23 System. An integrated composite of people, products, and processes that provide a capability to satisfy a stated need or objective.

3.24 Tolerable. See Acceptable Risk.

3.25 Top Management. The person(s) who has responsibility for, and give direction to, an organization and bears the ultimate authority for defining acceptable risk levels for the organization.

3.26 Worst Conceivable Risk. The worst conceivable consequence from an incident that could occur, but probably will not occur~~,~~ within the lifetime of the system.

3.27 Worst Credible Consequence. The worst credible consequence from an incident that has the potential to occur within the lifetime of the system.

4. ROLES AND RESPONSIBILITY

4.1 Top management shall provide leadership to institute and maintain a policy and effective processes for the design and redesign processes through which:

1. Hazards are anticipated, identified, and evaluated for avoidance, elimination, or substitution.

2. Risks deriving from identified hazards are assessed and prioritized in accordance with accepted hazard analysis and risk assessment techniques (see Section 7).

3. Risks are reduced to an acceptable level through the application of the hierarchy of controls as described in Section 9.

4. The knowledge, skills, experience, insight, and creativity of employees close to the hazards and risks are utilized in the risk assessment process.

5. Design and/or redesign process effectiveness are monitored through feedback between employees and management to provide for continuous improvement.

6. Appropriate recordkeeping systems are developed and used to document design reviews and to track feedback and safety and health reports over the life cycle.

Note: The processes of identifying and analyzing hazards and assessing risks improve if management establishes a culture where employee knowledge is valued and respected and they collaborate in significant aspects of the design and redesign activities. Employees who do the work can make valuable contributions in identifying and evaluating hazards, in risk assessments, and proposing risk reduction measures.

4.2 Top management shall carry out the responsibilities of 4.1 when:

- New facilities, equipment, technologies, materials, and processes are being planned, designed, acquired, or installed.

- Alterations are made in existing facilities, equipment, technologies, materials, and processes.

- Incident investigations are made and corrective actions are taken.

- Demolition, decommissioning or reusing/rebuilding operations are undertaken.

4.3 Top management shall apply the applicable portions of Section 7 to achieve acceptable risk levels.

- Top management shall make clear to all personnel (and subcontractors) that the goal of the risk assessment process is to achieve acceptable risk levels.

- The development of acceptable risk levels begins with the establishment of occupational safety and health goals during conceptual design, at the same time when occupational hazards are anticipated. During preliminary design, acceptable risk targets for the hazards that cannot be eliminated are established. These acceptable risk targets will assist in the design/identification of risk control alternatives. See also Addenda A and B.

4.4 Top management shall determine that the design process includes input from those who have design responsibilities, safety and health professionals, maintenance personnel, supervisors,

operations personnel who will be affected, and safety and health professionals, to the extent practicable.

4.5 Top management shall use one or more of the following methods, as deemed appropriate, to meet the responsibilities of 4.1 – 4.3.

- Designate personnel within the organization who have the necessary knowledge and skills to anticipate, identify and analyze hazards and assess the risks deriving from them and determine that appropriate training to acquire the necessary knowledge and skills is given.

- Engage outside consultants with expertise in hazard identification and analysis and risk assessment to assist with the acquisition or redesign of existing or new facilities, equipment, technologies, materials, or processes.

- Enter into written contracts/arrangements with suppliers of newly acquired facilities, equipment, technologies, processes, or materials to fulfill these responsibilities (see Section 5).

4.6 Since application of and adherence to prevention through design principles requires coordinated efforts of multiple parties along the lifecycle continuum, top management shall establish effective and appropriate communication plans. These plans should address design and redesign specifications and the risk assessment process. They should be communicated to all persons who are involved or who could be impacted by the design decisions made.

Information addressing the newly revised ANSI/ASSE Z590.3 Standard

***The link below is the press release addressing the approval of Z590.3 and gives logistical details:

http://www.asse.org/en/index.php/press_releases/asse-announces-approval-of-ground-breaking-z590-3-standard-for-prevention-through-design/

***The link below is to an article about PTD written by Z590.3 Chair Fred Manuele in 2007:

http://www.asse.org/practicespecialties/engineering/docs/ByDesign_PtDSpecial_Fall2007.pdf

***The link below is to an interview about Z590.3, which was done with Z590.3 participant Wayne Christensen:

http://www.asse.org/professionalsafety/docs/1104Christensen_interview.pdf

***One of the main questions asked by SH&E Professionals is how are voluntary national consensus standards like Z590.3 used by government agencies? The articles below should give some solid insight into this question:

http://www.ansi.org/news_publications/other_documents/safeguarding.aspx?menuid=7

http://www.asse.org/publications/standards/docs/PositionStatementonConsensusStandards.pdf

http://www.asse.org/publications/standards/docs/Dembystandardsarticle3-21-2006.doc

***ANSI Information

http://www.ansi.org/

***Recognition: The standard is new at this point so there will not be specific citations and/or references to point to. NIOSH and OSHA have been very interested in the PTD concept and some examples are listed below:

http://www.cdc.gov/niosh/topics/ptd/

http://www.cdc.gov/niosh/docs/2011-121/