MANDATORY APPENDIX III
SAFEGUARDING

III-1 SCOPE

Safeguarding is the provision of protective measures to minimize the risk of accidental damage to the piping or to minimize the harmful consequences of possible piping failure.

In most instances, the safeguarding inherent in the facility (the piping, the plant layout, and its operating practices) is sufficient without need for additional safeguarding. In some instances, however, engineered safeguards must be provided.

Appendix G outlines some considerations pertaining to the selection and utilization of safeguarding. Where safeguarding is required by the Code, it is necessary to consider only the safeguarding that will be suitable and effective for the purposes and functions stated in the Code or evident from the designer’s analysis of the application.

III-2 GENERAL CONSIDERATIONS

In evaluating a piping installation design to determine what safeguarding may exist or is necessary, the following should be reviewed:

(a) the hazardous properties of hydrogen, considered under the most severe combination of temperature, pressure, and composition in the range of expected operating conditions.

(b) the quantity of hydrogen that could be released by piping failure, considered in relation to the environment, recognizing the possible hazards ranging from large releases to small leakages.

(c) expected conditions in the environment, evaluated for their possible effect on the hazards caused by a possible piping failure. This includes consideration of ambient or surface temperature extremes, degree of ventilation, proximity of fired equipment, etc.

(d) the probable extent of operating, maintenance, and other personnel exposure, as well as reasonably probable sources of damage to the piping from direct or indirect causes.

(e) the probable need for grounding, bonding, or specialized electrostatic discharge techniques to minimize ignition of released hydrogen due to accumulation of static charges.

(f) the safety inherent in the piping by virtue of materials of construction, methods of joining, and history of service reliability.

III-3 SAFEGUARDING BY PLANT LAYOUT AND OPERATION

Representative features of plant layout and operation which may be evaluated and selectively utilized as safeguarding include

(a) plant layout features, such as open-air process equipment structures, spacing and isolation of hazardous areas, buffer areas between plant operations and populated communities, or control over plant access

(b) protective installations, such as fire protection systems, barricades or shields, ventilation to remove released hydrogen, and instruments for remote monitoring and control

(c) operating practices, such as restricted access to processing areas; work permit system for hazardous work; or special training for operating, maintenance, and emergency crews

(d) means for safe discharge of hydrogen released during pressure-relief device operation, blowdown, cleanout, etc.

(e) procedures for startup, shutdown, and management of operating conditions, such as gradual pressurization or depressurization, and gradual warmup or cooldown, to minimize the possibility of piping failure

III-4 ENGINEERED SAFEGUARDS

Engineered safeguards that may be evaluated and selectively applied to provide added safeguarding include

(a) means to protect piping against possible failures, such as

(1) thermal insulation, shields, or process controls to protect from excessively high or low temperature and thermal shock

(2) armor, guards, barricades, or other protection from mechanical abuse

(3) damping or stabilization of process or fluid flow dynamics to eliminate or to minimize or protect against destructive loads (e.g., severe vibration pulsations, cyclic operating conditions)

(b) means to protect people and property against harmful consequences of possible piping failure, such as confining and safely disposing of escaped hydrogen by shields for flanged joints, valve bonnets, or gages