Proposal:

E3609.7 Bonding other metal piping. Where installed in or attached to a building or structure, metal piping systems, including gas piping, capable of becoming energized shall be bonded to the service equipment enclosure, the grounded conductor at the service, the grounding electrode conductor where of sufficient size, or to the one or more grounding electrodes used. ~~The bonding jumper shall be sized in accordance with Table E3908.12, using the rating of the circuit capable of energizing the piping. The equipment grounding conductor for the circuit that is capable of energizing the piping shall be permitted to serve as the bonding means.~~ The points of attachment of the bonding jumper(s) shall be accessible.

(1) Other than Corrugated Stainless Steel Tubing (CSST). The bonding jumper(s) shall be sized in accordance with Table E3908.12, using the rating of the circuit capable of energizing the piping. The equipment grounding conductor for the circuit that is capable of energizing the piping shall be permitted to serve as the bonding means.

(2) CSST. Corrugated stainless steel tubing gas piping systems shall be bonded by connection to a metallic piping segment or fitting, either outside or inside the building, between the individual gas meter and the first CSST fitting. The bonding jumper shall be sized in accordance with Table E3603.1 based on the size of the service-entrance conductor or feeder supplying each occupancy but not smaller than 6 AWG copper (or equivalent).

Technical Substantiation:

The 2009 International Residential Code includes a requirement to bond CSST gas piping systems directly to the grounding electrode system in stead of relying on the equipment grounding conductor to provide the means of bonding the gas piping system (see Section G2411.1.1). However, the electrical Section E3609.7 does not currently cover this specific bonding requirement. The attached proposal attempts to reconcile the bonding requirements between these two sections of the code.

It is well known that direct bonding of metallic systems to the grounding electrode system will reduce the chances of arcing between electrically conductive pathways when energized by a high voltage source. The term “direct” bonding is intended to mean the use of a dedicated conductor and appropriately listed clamps to make an electrical connection between the piping and the grounding electrode system in the shortest and most straightforward path practical. In addition, the NFPA 780 Standard for Lightning Protection Systems recommends “equipotential” bonding of all metallic systems to reduce the potential for damage when energized by lightning. Although Section E3609.7 allows the use of the equipment grounding conductor as the bonding means for a gas piping system (for personal safety purposes from ground faults), it is not intended to preclude the direct bonding of the piping system. The 2008 NEC Handbook commentary supports this interpretation.

The CSST industry has performed laboratory testing and engineering analysis on direct bonding that clearly demonstrates a reduction in the potential for arc-induced damage to CSST when energized by lightning energy. All CSST manufacturers now recommend the direct bonding of CSST to the grounding electrode system of the premise in which it is installed utilizing at least a 6 AWG copper wire or equivalent. The point of bonding attachment is near the point where the gas piping enters the premise using a standard bonding clamp installed in accordance with its listing to the UL 467 standard. In addition, the ANSI standard for CSST systems (ANSI LC-1) is

being updated to include a requirement for direct bonding instructions and performance requirements to verify the electrical properties.

The NFPA 54/National Fuel Gas Code Technical Committee considered published reports of damage to the CSST from lightning strikes and recommended new coverage for the bonding of CSST systems in the 2009 edition. Subsequently, the 2009 editions of both the International Fuel Gas Code and the International Residential Code have also been updated to include this new CSST bonding requirement. That language (in part) includes the following requirement:

7.13.2 CSST. CSST gas piping systems shall be bonded to the electrical service grounding electrode system at the point where the gas service enters the building. The bonding jumper shall not be smaller than 6 AWG copper wire or equivalent.

All CSST manufacturers have subsequently revised their installation requirements to mandate the direct bonding of all CSST systems. Combining the direct bonding of CSST with the existing Indiana requirement for physical separation between CSST and other metallic systems will provide improved safety to consumers.

The National Electrical Code contains many requirements for bonding of electrically conductive materials which include wiring, piping, ducts, communications cable and structural steel. These requirements are specified throughout the NEC and all have the common goal of protecting the public safety from electrical faults within the premise wiring system by establishing an effective, low-impedance ground fault current path. It is quite clear that the use of a 6 AWG copper bond wire is a well established approach for other similar conductive metallic systems; that a 6 AWG copper wire will be an effective means for diverting (to earth) the energy associated with an indirect lightning strike; and the use of direct bonding should be a familiar and straightforward solution to implement in the field by electrical contractors.

The use of the equipment grounding conductor (EGC) as the bonding means will not achieve the same effect. The EGC (which is typically a 12 or 14 AWG copper wire) does not allow the mechanical equipment and piping to be energized at (or near) the same rate as the electrical system following a lightning strike. The path to ground through the EGC is typically much longer (and with greater impedance) than the direct bonding distance (near the service entrance) between the piping system and the grounding electrode system. When energized by lightning, this situation permits the electrical potential in the many conductive pathways to become unbalanced, and thus arcing is more likely to occur. Bonding through the equipment grounding conductor is only intended for personnel safety in the event of an electrical fault occurring in the premise wiring system, and has been shown to be inadequate when dealing with lightning energy.