MEMORANDUM

TO: NFPA Technical Committee on Liquefied Petroleum Gas
FROM: Kimberly Shea
DATE: April 12, 2012
SUBJECT: NFPA 58 ROP TC FINAL Supplemental Ballot Results (A2013)

The date for receipt of ballots has passed. As there were no negative ballots received, ballot results are now final.

According to the final ballot results, Proposal 58-106a received the necessary affirmative votes to pass ballot.

30 Members Eligible to Vote
3 Not Returned (C. Garza-Obregon, S. Kastanas, G. Mahnken)
26 Affirmative
0 Negatives
1 Abstentions (F. Volgstadt)

The attached report includes several affirmative comments received and an explanation of the vote for the abstention. Voting comments received from alternate members are not included unless the ballot from the principal member was not received.

There are two criteria necessary for each proposal to pass ballot: (1) simple majority and (2) affirmative 2/3 vote. The mock examples below show how the calculations are determined.

(1) Simple Majority: Assuming there are 20 vote eligible committee members, 11 affirmative votes are required to pass ballot.

(20 members eligible to vote ÷ 2 = 10 + 1 = 11)

(2) Affirmative 2/3: Assuming there are 20 vote eligible committee members, 1 ballot not returned and 2 abstentions, the number of affirmative votes required would be 12.

(20 members eligible to vote – 1 not returned – 2 abstentions = 17 x 0.66 = 11.22 = 12)
6.16 Corrosion Protection.
6.16.1 All metallic equipment and components that are buried, above ground or mounded, or any combination thereof, shall be coated and maintained to minimize corrosion.

The piping coating system shall be recommended for the intended service or soil environment and applied per manufacturer's requirements.

6.16.2 Corrosion protection of all other materials shall be in accordance with accepted engineering practice.
6.16.2.1 Cathodic protection (CP) corrosion protection systems in accordance with NACE RP 01-69 shall be installed on new installations of underground, partially buried or mounded steel piping or tubing, unless technical justification is provided to and is approved by the authority having jurisdiction (AHJ). Verification shall be in accordance with NACE RP 1069 on the schedule defined in 6.16.2.3 and 6.16.2.4.
6.16.2.2* Cathodic protection systems (Sacificial Anodes or Impressed Fields) installed in accordance with 6.16.2.1 shall be monitored by testing and the results documented. Confirming tests for steel systems shall be described by one of the following:

1. Producing a voltage of -0.85 volts or more negative, with reference to a saturated copper-copper sulfate half cell
2. Producing a voltage of -0.78 volts or more negative, with reference to a saturated KCl calomel half cell
3. Producing a voltage of -0.80 volts or more negative, with reference to a silver-silver chloride half cell
4. Any other method described in Appendix D of Title 49 of the Code of Federal Regulations, Part 192

6.16.2.3* Sacificial anodes installed in accordance with 6.16.2.1 shall be tested in accordance with the following schedule:

1. Upon installation of the cathodic protection system, unless prohibited by climatic conditions, in which case testing shall be done within 180 days after the installation of the system.
2. For continued verification of the effectiveness of the system, 12 to 18 months after the initial test.
3. Upon successful verification testing and in consideration of previous test results, periodic follow-up testing shall be performed at intervals not to exceed 36 months.
4. Systems failing a test shall be repaired as soon as practical unless climatic conditions prohibit this action, in which case the repair shall be made not more than 180 days thereafter. The testing schedule shall be restarted as required in 6.16.2.3(1) and (2), and the results shall comply with 6.16.2.2.
5. Documentation of the results of the two most recent tests shall be retained.

6.16.2.4* Where an impressed current cathodic protection system is installed, it shall be inspected and tested in accordance with the following schedule:

1. All sources of impressed current shall be inspected and tested at intervals not exceeding two months.
2. All impressed current cathodic protection installations shall be inspected and tested annually.

6.16.2.5 Prior to burial, the piping shall be visually examined for damage to the coating. Damaged areas shall be repaired with a coating repair procedure recommended for underground service and compatible with the existing coating. In no case shall the repaired area exhibit a lower corrosion resistance than the existing coating.

A.6.16.2.2 See A.6.6.6.1(I).
A.6.16.2.3 See A.6.6.6.1(K).
A.6.16.2.4 See A.6.6.6.1(L).

Substantiation: Currently, NFPA 58 required a coating, and cathodic protection systems for all buried tanks, however there is no requirement for buried piping systems.

A recent incident in South Carolina in an industrial plant took the life of a transport driver and had the potential to cause significant loss of life as well as significant property damage.

The root cause of the incident (leakage of liquid propane from the buried steel piping system) was the complete lack of any cathodic protection on any length of the piping together with a poor mechanical barrier coating (paint, tape) system.

Committee Meeting Action: Accept in Principle in Part
6.6.6.1* ASME container assemblies intended for underground installation, including interchangeable aboveground–underground container assemblies, shall be installed underground in accordance with 6.6.6.1(A) through 6.6.6.1(O).

(A) through (H) unchanged
A corrosion protection system shall be installed on new installations of underground steel containers, unless technical justification is provided to and is approved by the authority having jurisdiction. The corrosion protection system shall include the following:

1. A container coating complying with 5.2.1.11
2. A cathodic protection system that consists of a sacrificial anode(s) or an impressed current anode
3. A means to test the performance of the cathodic protection system in accordance with 6.16.3.

Cathodic protection systems installed in accordance with 6.6.6.1(l) shall be monitored by testing and the results documented. Confirming tests shall be described by one of the following:

1. Producing a voltage of −0.85 volts or more negative, with reference to a saturated copper-copper sulfate half cell
2. Producing a voltage of −0.78 volts or more negative, with reference to a saturated KCl calomel half cell
3. Producing a voltage of −0.80 volts or more negative, with reference to a silver-silver chloride half cell
4. Any other method described in Appendix D of Title 49 of the Code of Federal Regulations, Part 192

Sacrificial anodes installed in accordance with 6.6.6.1(l) above shall be tested in accordance with the following schedule:

1. Upon installation of the cathodic protection system, unless prohibited by climatic conditions, in which case testing shall be done within 180 days after the installation of the system.
2. For continued verification of the effectiveness of the system, 12 to 18 months after the initial test.
3. Upon successful verification testing and in consideration of previous test results, periodic follow-up testing shall be performed at intervals not to exceed 36 months:
4. Systems failing a test shall be repaired as soon as practical unless climatic conditions prohibit this action, in which case the repair shall be made not more than 180 days thereafter. The testing schedule shall be restarted as required in 6.6.6.1(K)(1) and (2), and the results shall comply with 6.6.6.1(J).
5. Documentation of the results of the two most recent tests shall be retained.

Where an impressed current cathodic protection system is installed, it shall be inspected and tested in accordance with the following schedule:

1. All sources of impressed current shall be inspected and tested at intervals not exceeding two months.
2. All impressed current cathodic protection installations shall be inspected and tested annually.
3. Prior to burial, the container shall be visually examined for damage to the coating. Damaged areas shall be repaired with a coating recommended for underground service and compatible with the existing coating.
4. Containers shall be set level and shall be surrounded by earth or sand firmly tamped in place.
5. Backfill shall be free of rocks and abrasives.

Partially underground, unmounded ASME containers shall be installed as follows:

1. The portion of the container below the surface of the ground, and for a vertical distance of at least 3 in. (75 mm) above that surface, shall comply with the corrosion protection requirements of 6.6.6.1(l) through (M). The aboveground portion of the container shall comply with 6.6.1.4.
2. Containers shall be set level and shall be surrounded by earth or sand firmly tamped in place.
3. Backfill shall be free of rocks and abrasives.
4. Spacing provisions shall be as specified for aboveground containers in 6.3.1 and Table 6.3.1.
5. The container shall be located so as not to be subject to vehicular damage or shall be protected against such damage.

Metallic piping and tubing shall be protected against corrosion as warranted by soil conditions as follows:

A. Piping and tubing of 1-inch nominal diameter or smaller shall be protected in accordance with 6.16.1 or 6.16.2.
B. Piping and tubing larger than 1-inch nominal diameter and installed above ground shall be protected in accordance with 6.16.1.
C. Steel piping larger than 1-inch nominal diameter and installed underground shall have a cathodic protection system in accordance with 6.16.2(C) unless technical justification is approved by the authority having jurisdiction.

All metallic equipment and components that are buried or mounded shall be coated or protected and maintained to minimize corrosion:

Corrosion protection of all other materials shall be in accordance with accepted engineering practice.

All materials and equipment installed aboveground shall be of corrosion resistant material or shall be coated or protected to minimize exterior corrosion.

Except for underground and mounded containers (see 6.6.6), all materials and equipment that are buried or mounded shall comply with one of the following requirements:

A. Materials and equipment shall be made of corrosion-resistant material which are suitable for the environment in...
which they will be installed.
(B) Materials and equipment shall be manufactured with a corrosion-resistant coating, or have a coating applied prior to being placed into service.
(C) Materials and equipment shall have a cathodic protection system installed and maintained in accordance with 6.16.3.
6.16.3 Where installed, cathodic protection systems shall comply with the following:
6.16.3.1* Cathodic protection systems installed in accordance with this code shall be monitored by testing and the results documented. Confirming tests shall be described by one of the following:
(A) Producing a voltage of \(-0.85\) volts or more negative, with reference to a saturated copper-copper sulfate half cell
(B) Producing a voltage of \(-0.78\) volts or more negative, with reference to a saturated KCl calomel half cell
(C) Producing a voltage of \(-0.80\) volts or more negative, with reference to a silver-silver chloride half cell
(D) Any other method described in Appendix D of Title 49 of the Code of Federal Regulations, Part 192
6.16.3.2* Sacrificial anodes shall be tested in accordance with the following schedule:
(A) Upon installation of the cathodic protection system, unless prohibited by climatic conditions, in which case testing shall be done within 180 days after the installation of the system.
(B) For continued verification of the effectiveness of the system, 12 to 18 months after the initial test.
(C) Upon successful verification testing and in consideration of previous test results, periodic follow-up testing shall be performed at intervals not to exceed 36 months.
(D) Systems failing a test shall be repaired as soon as practical unless climatic conditions prohibit this action, in which case the repair shall be made not more than 180 days thereafter. The testing schedule shall be restarted as required in 6.16.3.2(A) and (B), and the results shall comply with 6.16.3.2.
(E) Documentation of the results of the two most recent tests shall be retained.
6.16.3.3* Where an impressed current cathodic protection system is installed, it shall be inspected and tested in accordance with the following schedule:
(A) All sources of impressed current shall be inspected and tested at intervals not exceeding two months.
(B) All impressed current cathodic protection installations shall be inspected and tested annually.

A.6.6.1(J) becomes A.6.16.3.1.
A.6.6.1(K) becomes A.6.16.3.2.
A.6.6.1(L) becomes A.6.16.3.3.
A.6.6.1(N) becomes A.6.6.6.1(K).

Committee Statement: The substantiation for the proposal speaks of a liquid leak from an improperly protected buried steel liquid piping system at an industrial plant. The proposal seeks to address corrosion failures of buried piping systems to prevent future occurrences of this kind.

However, the scope of the proposal goes far beyond addressing piping at bulk plants and commercial installations, which is where the accident occurred. The proposal addresses all metallic components of an LP-gas system, both aboveground and underground, and requires that they be coated. This includes brass and bronze fittings and valves, aluminum regulator bodies, rubber hose, stainless steel fittings, and other materials that are designed for exterior use without the need to be coated.

In addition, the proposal extends to all types of metallic piping systems, and would require cathodic protection on residential vapor piping systems made of copper tubing. The submitter reported to the committee that his intent was to require cathodic protection on larger steel piping at bulk plants and industrial plants, which poses a much greater potential hazard than domestic vapor systems.

With the support and input from the submitter of the original proposal, this alternative proposal will accomplish the submitter’s intent as follows:
1. Adds a new section (6.16.1) to specify the requirements for protecting above ground equipment and piping from corrosion. This requirement recognizes that some materials are inherently protected from corrosion and no additional measures are needed.
2. Revises 6.16.2 to acknowledge that some materials may be suitable for installation underground with no additional corrosion protection. If not, two methods of providing supplemental corrosion protection are included. Underground and mounded containers are exempted from the requirements of 6.16.2 because they are addressed in 6.6.6.
3. Creates a separate section for the monitoring and testing requirements for cathodic systems (6.16.3), rather than duplicating these requirements in separate areas of the code. This will facilitate easier reference to the requirements where other sections of the code require a cathodic protection system to be installed.
4. Implements a minimum pipe size for the mandatory installation of cathodic protection on underground steel
piping (greater than 1-inch diameter) in 6.16.3.2(C) that will limit the scope of the requirement to bulk plant, industrial plant, and commercial applications, in line with the submitter’s original intent. Other piping sizes and their service condition (aboveground or underground) are addressed in (A) and (B).

The revised proposal will require that all underground steel piping systems greater than one inch nominal diameter be cathodically protected. The cathodic systems will carry the same monitoring and maintenance requirements as those for underground tanks. In addition, all gas system metallic components will either be made of corrosion resistant materials or coated to minimize corrosion. The revised proposal accomplishes the submitter’s intent, eliminates the unintended requirements of the original proposal, and streamlines the cathodic protection maintenance and testing requirements into one section that can be used for multiple applications.

Number Eligible to Vote: 30
Ballot Results: Affirmative: 26 Abstain: 1
Ballot Not Returned: 3 Garza-Obregon, C., Kastanas, S., Mahnken, G.

Comment on Affirmative:
BARBER, D: In supporting the changes I wish to add the following comments.
1. I have personal experience, as an expert witness, of an incident which resulted in 9 fatalities and 30 injured. It was as a result of a leakage of a badly corroded pipe carrying propane at medium pressure 15 psi.
2. I recommend adding the following words. ‘Backfill shall be non-corrosive and free of rocks and abrasives. The backfill in the incident at 1 above was very corrosive.
3. the minimum pipe diameter of 1 inch should apply to vapour systems only.
I recommend that all lines carrying liquid propane should have protection.
BURNELL, D: I think that all underground steel piping should be cathodically protected not limit it to piping over one inch. There is not much used but when it is used, the same risks are there.

HOFFMANN, R: With respect to the letter ballot on items 58-106A, log number 165. The final action of the committee was to accept in principle, in part. I vote in the affirmative with comment to this action because it improves the standard immeasurably from a corrosion aspect, but shortcomings exist.

I recognize the “greater than 1” nominal diameter steel pipe” size criteria for the application of cathodic protection limits the mandatory application of the cathodic protection program to bulk plants and commercial installations. The application of cathodic protection to underground piping is a step in the right direction.
This change, however, leaves underground steel pipes which are less than 1” nominal diameter to be protected from corrosion by complying with the requirements of 6.16.2:
6.16.2 Except for underground and mounded containers (see 6.6.6), all materials and equipment that are buried or mounded shall comply with one of the following requirements:
(A) Materials and equipment shall be made of corrosion-resistant material which are suitable for the environment in which they will be installed.
(B) Materials and equipment shall be manufactured with a corrosion-resistant coating, or have a coating applied prior to being placed into service.
(C) Materials and equipment shall have a cathodic protection system installed and maintained in accordance with 6.16.3.

It is my opinion this size separation criterion for the incorporation of cathodic protection for steel piping is not in the best interest of the LP industry. The corrosion of carbon steel piping, regardless of its protection system (A or B, not C), is continual, without any regard to pipe size. The reality is that the smaller the pipe diameter, the thinner the wall thickness becomes.

Secondly, annex material has to be created which gives a road map for complying with the term “suitable for the environment in which they will be installed.”

Stainless steels are not to be considered corrosion resistant in a buried condition in a bare or coated condition. To determine a material as “suitable for the environment in which it is to be installed” without a qualification list is a point of concern; not every installation is in the dry desert sand environment.

In summary, I vote affirmative with comment on this ballot. It is a significant improvement in the corrosion protection program incorporated in NFPA 58. The comments and concerns presented in this letter are for the Technical Committee to Consider in the next improvements for NFPA 58.

OSTERHAUS, J: Consideration should be given to expanding the requirement for cathodic protection to all steel piping in contact with the soil, regardless of pipe diameter.
WILSON, T: I agree with the committee except that I think 1” and smaller pipe should also be included. I have seen leaks in the smaller size piping due to the same problems affecting the larger size pipe.