

NEC CODE QUESTIONS and ANSWERS
Wisconsin Chapter IAEI – Green Lake, Wisconsin
May 16-18, 2012

1. Can we install 120 Volt conductors in the same space with 277 Volt conductors? If the answer is yes, are there any restrictions that apply?

ANS: Yes, in accordance with Section 300.3 (C)(1) of the NEC “Conductors of ac and dc circuits, rated 600 volts, nominal, or less shall be permitted to occupy the same equipment wiring enclosure, cable, or raceway. All conductors shall have an insulation rating equal to at least the maximum circuit voltage applied to any conductor within the enclosure, cable, or raceway.” There is an exception that prohibits this mixed use for photovoltaic systems in accordance with Section 690.4(B).

2. We are working on the design of a new assisted living building. The owner would like the egress lighting on an emergency generator, along with some miscellaneous loads such as coolers and freezers. I think we need separate transfer switches for the two branches of standby power. One transfer switch for life safety and an additional switch for optional equipment. The owner stated they just completed a new building about a year ago that only has one transfer switch and life safety lighting as well as equipment loads are on the same transfer switch. My question is has anything changed to where I would not require two transfer switches?

ANS: You are correct in that 2 transfer switches would be required as well as the ability to shed the non-emergency loads. NFPA 110 as adopted in the International Building Code (IBC) is the code for generators along with the NEC Article 700, Emergency System, Article 701, Legally Required Standby Systems and Article 702, Optional Standby Systems. The other building could have been a small nursing home and in Article 517 they are allowed a single transfer switch for the critical and life safety branches of the essential electrical system.

3. Is it permitted to use the same EGC (equipment grounding conductor) for two separate systems with two different voltages, such as a 277/480 and a 120/240 volt system?

ANS: Yes, NEC Section 250.122 (C) says “Where a single equipment grounding conductor is run with multiple circuits in the same raceway, cable, or cable tray, it shall be sized for the largest overcurrent device protecting conductors in the raceway, cable, or cable tray.” This makes sense since a multiple circuits from different voltage systems could be in the same raceway where the raceway serves as the EGC for both or multiple systems. The EGC is still required to terminate in the panel where the circuits originate and that may require taps or splices. Depending on the overcurrent devices the GEC taps may be different in size.

4. Can plastic or nonmetallic boxes be used with metal clad cables, armored cables or metal raceways?

ANS: Yes, provided the design and construction meets one of the exceptions to Section 314.3. the base rule in NEC Section 314.3 states: “Nonmetallic boxes shall be permitted only with open wiring on insulators, concealed knob-and-tube wiring, cabled wiring methods with entirely nonmetallic sheaths, flexible cords, and nonmetallic raceways.” This limits the use of metallic wiring methods while the exceptions provide options. Exception No. 1 says; “Where internal bonding means are provided between all entries, nonmetallic boxes shall be permitted to be used with metal raceways or metal-armored Cables.” Exception No. 2 states: “Where integral bonding means with a provision for attaching an equipment bonding jumper inside the box are provided between all threaded entries in nonmetallic boxes listed for the purpose, nonmetallic boxes shall be permitted to be used with metal raceways or metal-armored cables.”

5. Can a 1500 watt heat-fan-light unit be supplied from the required 20-ampere receptacle branch circuit in the bathroom of a dwelling unit?
ANS: No, the exception to 210.11(3)(C) permits other loads to be supplied from this 20-ampere circuit if it supplies a single bathroom but 210.23(A)(2) limits the load of utilization equipment that is fastened in place to 50 percent of the ampere rating of the branch circuit. The full load current of this unit exceeds 50 percent of the bathroom branch circuit rating and is not permitted on the required receptacle circuit.
6. Does a fire escape landing require a receptacle outlet? Does section 210.52(E)(3) apply in this case? The building is a multifamily dwelling.
ANS: No, Section 210.52(E)(3) of the NEC does not apply to fire escape landings and require a receptacle outlet. If you are referring to the jump platforms that were allowed on some multifamily buildings they would be considered balconies and a receptacle outlet would be required on new construction. A fire escape landing would be on an older existing building since the building code typically requires enclosed stairways for building egress of more than 10 persons. The installation of a receptacle outlet in a required path of egress could create a problem. We would not allow persons to camp in a fire stairway why would you encourage it on a fire escape? A fire escape did not require egress lighting which is a relatively new requirement in the building code. The requirements of the NEC apply to new construction and are only retroactive where indicated.
7. We increased the size of the circuit conductors on a pumping station to compensate for the voltage drop. We increased in size from a #6 AWG copper to a 1/0 copper conductor. What if anything needs to be done with the equipment grounding conductor when the circuit conductors are increased?
ANS: NEC Section 250.122 (A) says: "Where ungrounded conductors are increased in size, equipment grounding conductors, where installed shall be increased in size proportionately according to the circular mil area of the ungrounded conductors." Assuming the #6 circuit conductor rated at 60 Amperes requires a #10 equipment grounding conductor in accordance with Table 250.122, we get the multiplier for the proportionate increase by taking the (cmil 1/0 / cmil #6) = (105600/26240) = 4.02 times (cmil #10) = 4.02(10380) = 41773 cmil or #3 copper at 52620 cmil since a #4 is only 41740 cmil and is not large enough. Table 8 Conductor Properties is used for the cmil numbers.
8. A building has an existing electrical service with existing grounding. The grounding electrode system does not include a concrete encased electrode. An addition is added to the existing building with no change to the electrical service. Footings are being poured which include concrete encased electrodes or reinforcing bars in the footing. In accordance with National Electrical Code article 250.50 *Grounding Electrode System. All grounding electrodes as described in 250.52(A)(1) through (A)(7) that are present at each building or structure served shall be bonded together to form the grounding electrode system.* Would the concrete encased electrode be required to be attached to the existing grounding electrode system?
ANS: Yes, it needs to be connected. If an underground metal water pipe were added it would require use as an electrode as well as bonding. A concrete encased electrode would not provide the same type of hazard but it is still a hazard and when an electrode is added to a building it needs to be bonded to the system.
9. Can I install 5 # 6 AWG, THHN conductors in a three quarter inch diameter EMT or do I have to use 1- inch diameter?
ANS: Annex C.1. NEC Table C.1 permits four #6 AWG THHN conductors in a 3/4" (EMT) electrical metallic tubing. In order to get 6 conductors you would have to increase the raceway size to 1 inch.

10. In Section 310.15.B(4)(a) of the NEC, it indicates "A neutral conductor that carries only the unbalanced current from other conductors of the same circuit shall not be required to be counted when applying the provisions of 310.15(B)(2)(a)". The application in question is a 2 wire single-phase circuit and the concern is whether or not we need to derate all of the conductors when (4) such 2-wire circuits are combined in the same raceway? We are of the understanding that derating is not necessary in this application, in accordance with the above noted language.
ANS: Section 310.15.B(4)(a) of the NEC says "A neutral conductor that carries only the unbalanced current from other conductors of the same circuit shall "NOT" be required to be counted when applying the provisions of 310.15(B)(2)(a)". The rule says the unbalanced current from other conductors. This means a multiwire branch circuit as noted in Article 100 definitions, ie. Two or more ungrounded conductors that have a voltage between them, and one grounded conductor that has equal voltage between it and each ungrounded conductor of the circuit and that is connected to the neutral or grounded conductor of the system. In a multiwire circuit the neutral currents are canceled for the most part. With a two wire circuit as you describe the current flow on the ungrounded conductor equals the return current on the grounded conductor and heating is increased accordingly since there is no cancelation of current. As an example on a multiwire branch circuit the ungrounded conductors each carry 10 amperes and the grounded conductor sees a net of 0 amperes. Four two-wire circuits is 8 conductors and the derating is 70% according to Table 310.15 (B)(2)9a) . If you set them up as a multiwire you could get the number of current carrying conductors down to 4 and the derating would be at 80%.
11. As I was going through the NEC preparing for a class, I ran across some additions to Article 314 in the 2008 edition that I do not understand. I cannot come up with an example of where Section 314.24 (C) applies. This entire section is referring to utilization equipment in boxes. I cannot think of an example of where utilization equipment is installed in a box. I can think of many examples that involve devices but that is not what I believe this section is referring to. Your clarification is appreciated.
ANS: To differentiate we need to look at the definition of a device (receptacle, switch etc.) versus utilization equipment (general term including devices). An example of utilization equipment could be a horn, strobe or combination device for a fire alarm system. It could include luminaires or devices such as large dimmer type switches. By definition utilization equipment utilizes electric energy for electronic, electromechanical, chemical, heating, lighting, or similar purposes. An hour meter is another example I can think of as well as a receptacle with a light is utilization equipment.
12. We are working on the design of a new assisted living building. The owner would like the egress lighting on an emergency generator, along with some miscellaneous loads such as coolers and freezers. I think we need separate transfer switches for the two branches of standby power. One transfer switch for life safety and an additional switch for optional equipment. The Owner stated they just completed a new building about a year ago that only has one transfer switch and life safety lighting as well as equipment loads are on the same transfer switch. My question is has anything changed to where I would not require two transfer switches?
ANS: You are correct in that 2 transfer switches would be required as well as the ability to shed the non-emergency loads. NFPA 110 as adopted in the International Building Code (IBC) is the code for generators along with the NEC Article 700, Emergency System, Article 701, Legally Required Standby Systems and Article 701, Optional Standby Systems. The other building could have been a small nursing home and in Article 517 they are allowed a single transfer switch for the critical and life safety branches of the essential electrical system.
13. Does a residential smoke detector have to be on a dedicated circuit or can it be connected to the bedroom or kitchen circuit?
ANS: No, by smoke detector I will assume you are referring to the single or multiple-station smoke alarms commonly used in residential occupancies. NFPA 72 has the following

requirement for the primary power source: 29.6.1 Smoke and Heat Alarms. Smoke and heat alarms shall be powered by one of the following means: (1) A commercial light and power source along with a secondary power source that is capable of operating the device for at least 24 hours in the normal condition, followed by 4 minutes of alarm. The NEC does not specify a dedicated circuit. The outlets for the smoke alarms are interconnected and some of them are in rooms or areas that require AFCI protected circuits, the smoke alarms will be on these circuits. The logical choice is a lighting circuit serving the area since circuit failure would be noticeable.

14. When a UPS system of more than 750 volt amps is installed in a room does that make it an Information Technology (IT) Room and require installation in accordance with Article 645?
ANS: The requirements of Article 645 for Information Technology Rooms are only permitted to be applied if all of the conditions in 645.4 are met. Installing a UPS system or equipment in a room as indicated in the question does not trigger the requirements of Article 645.

15. I have been trying to get a response on an electrical question, but have not received anything yet. I was wondering if you could help me answer this question? Should overloads for motors be wired before or after the contactors? We get small electrical panels that are wired both ways, but I am wondering which way is correct. Most of these are for small motors from 1 to 5hp.
ANS: Your question is, should overloads be placed in a motor circuit ahead of or after the contacts or the controller? In reviewing the National Electrical Code (NEC) there does not seem to be a specified location. The diagram in Figure 430.1 shows the overloads after the contacts. This would be a logical place with ease of control for dropping all current to the motor with the contactor. Part III of Article 430 of the NEC, Section 430.38 says "Motor overload devices other than fuses or thermal protectors, shall simultaneously open a sufficient number of ungrounded conductors to interrupt current flow to the motor." It does not specify before or after the contacts.

16. Can a municipality require that fire alarm wiring be installed in Type MC (metal clad) cable or listed raceway.
ANS: Yes, provided it is a commercial building and not a multifamily dwelling covered by s.101.971, the Uniform Multifamily Dwelling Code. If the building is a multifamily dwelling in accordance with the Multifamily Dwelling Code it may follow the requirements in SPS 316 and the adopted National Electrical Code for Fire Alarm Systems, Article 760.

17. I am curious about the requirements for the power supply to a fire alarm control panel with battery backup located in the panel. Does this power supply (120 volt) need to be in a separate raceway? Is this branch circuit considered an emergency circuit? Not to blind side you, but I have asked this question in the past and have received different answers from different persons. I could see it either way and just want to be consistent with enforcement.

ANS: The branch circuit for a fire alarm power supply has always been considered emergency wiring. Your question made me look to see what NFPA says. They are silent. NFPA 72 Fire Alarm Code adds the following about the primary power supply.

10.5.5 Primary Power Supply. 10.5.5.1 Dedicated Branch Circuit. A dedicated branch circuit of one of the following shall supply primary power:

Commercial light and power

An engine-driven generator or equivalent in accordance with 10.5.10.2, where a person specifically trained in its operation is on duty at all times.

An engine-driven generator or equivalent arranged for cogeneration with commercial light and power in accordance with 10.5.10.2, where a person specifically trained in its operation is on duty at all times.

10.5.5.2 Circuit Identification and Accessibility. 10.5.5.2.1 The location of the dedicated branch circuit disconnecting means shall be permanently identified at the control unit.

10.5.5.2.2 For fire alarm systems the circuit disconnecting means shall be identified as "FIRE ALARM CIRCUIT."

10.5.5.2.3 For fire alarm systems the circuit disconnecting means shall have a red marking.

10.5.5.2.4 The circuit disconnecting means shall be accessible only to authorized personnel.

10.5.5.3 Mechanical Protection. The dedicated branch circuit(s) and connections shall be protected against physical damage.

This certainly looks like an emergency or life safety circuit.

18. I've got a contractor in my area that wants to install the disconnect for the air conditioner compressor unit inside the control panel instead of on the outside. He wants to install a 2 pole disconnect in a handy box. We normally see a weatherproof disconnect on the outside of these units where anyone servicing the unit can shut it off before working on the unit. Can we allow the disconnect inside of the control panel? NEC 440.14 says the disconnect needs to be in a readily accessible location. Would you consider inside the control panel to be readily accessible?

ANS: Section 440.14 allows the disconnect to be located on or within the air-conditioning or refrigerating equipment but not on panels that are designed to allow access to the equipment. It would be considered readily accessible in accordance with the definition in Article 100. From there go back to Section 440.12 to ensure the rating and interrupting capacity is acceptable per the nameplate ratings. The ampere rating must be at least 115% of the rated load current or branch circuit selection current whichever is greater. I am not sure if a 2 pole switch will meet this requirement?

19. In section 210.12 of the NEC it states that dinning room outlets need to be AFCI protected. How can we place the dinning room outlets on with my kitchen circuit like we always have and provide the AFCI protection?

ANS: The 2008 NEC (Wisconsin effective date January 1, 2009) requires the dining room outlets including receptacles to be on an AFCI protected circuit, but it does not prohibit the kitchen receptacles from also being on that circuit. It becomes a design issue where you may choose to use a separate circuit for the dining room or add the kitchen receptacles to the AFCI protected circuit of the dining room. An AFCI breaker can protect the small appliance circuit and GFCI protection can be added at the kitchen receptacles. The lighting outlets for the dining room cannot be on the small appliance circuits but may be added to other AFCI protected circuits.

20. We have a project in which we designed a clinic (type "B" business occupancy per IBC 2009 edition) for a major health care provider. There are simple examination rooms and an oncology area. I was having a conversation with the local inspector in the area about the use of Hospital Grade receptacles and I am hoping you would be able to shed some light on the subject. It appears that NEC 517.18(B) contains the requirement for hospital grade receptacles. However this article is requiring these types of receptacles at "patient bed" locations. We do not have any patient beds, nor do we meet the requirement for having four (4) receptacles also found in 517.18(B). I would like to draw your attention to a formal interpretation regarding Part II of Article 517 which contains Wiring and Protection requirements such as 517.26(B). In the 2005 handbook is Formal Interpretation 99-1. The question that prompted the interpretation reads as follows: "Does Part II of Article 517 of the NEC apply to patient sleeping areas of nursing homes or limited care facilities where patient care activities do not involve the use of electrical or electronic life support systems; or invasive procedures where patients are electrically connected to line connected electro medical devices?" The answer that amounts to the Formal Interpretation was no. It is my opinion that this particular clinic as well as almost all the small simple clinics that we build for health care providers would seem to fall into this exception. These clinics are definitely limited care facilities where patients are not connected to any life support systems. Furthermore, there are never invasive procedures where anesthetics or extended stays are necessary.

ANS: Section 517.18 (B) Patient Bed Receptacles; says "Each patient bed location shall be provided with a minimum of four receptacles. They shall be permitted to be of the single or duplex types or a combination of both. All receptacles, whether four or more, shall be listed

"hospital grade" and so identified. Checking the definition of patient bed location it says "inpatient sleeping bed; or the bed or procedure table used in a critical patient care area." An exam room does not require the hospital grade receptacles. Interestingly enough, my dentist has hospital grade receptacles throughout his clinic although they are not required. I suspect the designer/architect was adding to the cost? Just to ad, Oncology is a branch of medicine that deals with cancer.

21. What is the requirement for a concrete encased grounding electrode conductor? In article 250-52 (A) (3) it gives you the choice to connect to rebar or to place 20 feet of #4 bare, correct? We installed the 20 feet of # 4 bare copper conductor and created a concrete encased electrode, but the inspector says that we are required to connect to the reinforcing bar since it was also present.
ANS: Section 250.52 (3) Concrete-Encased Electrode says: "An electrode encased by at least 50 mm (2 in.) of concrete, located horizontally near the bottom or vertically, and within that portion of a concrete foundation or footing that is in direct contact with the earth, consisting of at least 6.0 m (20 ft) of one or more bare or zinc galvanized or other electrically conductive coated steel reinforcing bars or rods of not less than 13 mm (1/2 in.) in diameter, or consisting of at least 6.0 m (20 ft) of bare copper conductor not smaller than 4 AWG. Reinforcing bars shall be permitted to be bonded together by the usual steel tie wires or other effective means. Where multiple concrete-encased electrodes are present at a building or structure it shall be permissible to bond only one into the grounding electrode system." Since you created a concrete encased electrode and bonded it into the system there is no requirement to use the reinforcing bar(s).
22. What is the Code requirement for a maintenance disconnect serving a spa or hot tub?
ANS: Section 680.2 of the NEC requires a maintenance disconnecting means for all utilization equipment except lighting. The maintenance disconnecting means must be readily accessible and located within sight and at least 5 ft from the permanently installed pool, storable pool, outdoor spa, outdoor hot tub, or fountain equipment unless separated from the open water by a permanently installed barrier that provides a 5-ft reach path or greater. This horizontal distance is measured from the water's edge along the shortest path required to reach the disconnecting means [680.12].
23. Can nonmetallic cables such as Type NM and SE be used in commercial buildings of mixed construction types? For example, the above ground portion of the building may be Type V and the below grade parking garage may be Type IA construction.
ANS: The use of nonmetallic cables is tied into the type of construction. SPS 316.334-(1) Uses Permitted. The general permission is to allow NM cables to be used in commercial buildings of Types III, IV or V construction, except as prohibited in NEC 334.12. Construction types are defined in Chapter 6 of the 2009 International Building Code. The construction type is chosen by the building designer and validated during the plan review and approval process. Once this process is complete, the NEC requirements can then be applied. The architect or building designer has several choices. One is to utilize different types of construction for different parts of the building, but without firewalls or other recognized separation, the building would be approved for the lowest type of construction under the building code construction types. In the case of this example, the entire building would be approved as Type V construction. For buildings undergoing plan review, the type of construction is indicated in the in the header section of the state plan approval letter. The use of Nonmetallic Cables would be approved throughout the entire building, subject to the limitations in SPS 334.12. The building designer has other options. They can provide a firewall, which creates separate "buildings" for building code purposes that may have differing types of construction. In the example above, this would not be an option since a firewall is a vertical element, However, they can design the building in accordance with the conditions and restrictions in IBC 509.2, 509.3, 509.4 or 509.8 that allow stacked, differing types of construction. This allows them to treat each part of the overall structure as a "separate building". For buildings that undergo state plan approval, check the plan approval letter. A typical

statement in the letter would state: "IBC 509.2 - The designer has elected to use the design option of this section, which creates separate and distinct buildings for the purposes of area limitations, continuity of fire walls, number of stories, and type of construction when all of the conditions of this section are complied with, including a 3-hour separation between the upper and lower portions." is evidence of this choice. Or else consult with the building designer, local plan reviewer or local building official. Buildings designed under IBC 509.2, 509.3, 509.4 or 509.8 must be treated differently with respect to applying the electrical code. Using the previous example where the parking garage is Type IA construction and the above ground portion is Type V and the building is designed with a horizontal separation between the two parts of the building in accordance with 509.2. Types NM and SER cables could be utilized throughout the Type V portion of the structure. NM and SER cables are prohibited from being used in the Type II parking garage per SPS 316.334-(1).

24. The local inspector and I were having a discussion about a home owner who is finishing his basement. He has a wet bar area that includes a sink, dishwasher, under counter refrigerator, microwave and counter top spaces. His future plans involve adding an island. Does this qualify as a kitchen and require two small appliance circuits?

ANS: No, it is not a kitchen and small appliance circuits are not required. The accepted definition of a kitchen area is "An area with a sink and permanent facilities for food preparation and cooking." If a cooktop or range is added it becomes a kitchen area. A microwave does not meet the permanent provision for cooking.

25. We have a project where a contractor has installed a 480V motor control center that has an integral step-down transformer and lighting panel. The MCC contains the service entrance disconnect for the building and is 480V three wire. The MCC also has a 480-208Y/120V transformer that supplies a 120/208V three phase, four wire lighting panel. For some reason the lighting panel came without a ground bus so instead of getting one, the contractor ran all of the branch circuit grounds for the lighting panel to the MCC ground bus and not back to the lighting panel. Doesn't the NEC require that the lighting panel have a dedicated ground bus that is bonded to the neutral bus? And doesn't the neutral bus have to be grounded to the nearest grounding electrode? They are saying that "it's all the same ground" and that it's OK to ground the branch circuits at the 480V MCC ground bus.

ANS: You are correct in that the 120/208 secondary of the transformer is a separately derived system covered by Section 250.30 of the NEC. A system bonding jumper is required to be installed (Def: The connection between the grounded circuit conductor and the equipment grounding conductor at a separately derived system.) at the transformer or at the panel. If the system bonding jumper is at the transformer then the ground bar and neutral in the panel are separated. If the bond is in the panel the ground and neutral bar are one and the same like a service panel. Placing the equipment grounds on the 480 ground bus may not reference fault current imposed directly to the secondary of the transformer as you are relying on the metal equipment to carry the fault rather than the conductors. I suspect the system would work but it is not what the NEC requires for a separately derived system. A grounding electrode conductor is also required to be connected at the location where the separately derived system (secondary) is bonded.

26. This answer seems clear to me, but I told the installer I'd confirm it with you. Can Type MC cable be used in unlimited in length in hoistways and machine rooms of elevators in accordance with Section 620.21, Wiring Methods? It is not considered "flexible metal conduit" so it should not be limited to 6 feet or less by any of the requirements in 620.21.

ANS: You are correct, Type MC or AC cable do not have length restrictions. I would guess their reasoning on placing the limits on the use of Flexible Metal Conduit is based on limiting its use and length to 6 feet or less for equipment grounding purposes.

27. I have a situation where I have three sets of parallel conductors as well as two other single phase conductors. All conductors are for 480V power, the parallel conductors for a generator, and the two single phase conductors for a 480V panelboard in the generator enclosure. Is there any issue with running the two single phase conductors in with one of the parallel conductor sets other than conduit fill and conductor derating?

ANS: The answer is yes, there is an issue. Section 310.4 of the NEC has the requirements for conductors in parallel. (C) states where run in separate raceways the raceways with conductors shall have the same number and same electrical characteristics. By adding the single phase conductors you would totally change the heating characteristics for that raceway and it would not be possible to rely on similar characteristics for the paralleled conductors. An additional raceway for the single phase installation would eliminate the issue.

28. Can a transfer switch for a standby power system be located between the meter and an existing panelboard? Does the grounding electrode conductor and the main bonding jumper need to be relocated from the existing panelboard to the transfer switch?

ANS: Standby power systems are permitted to be connected ahead of an existing service disconnecting means only if such systems are provided with a separate disconnecting means and overcurrent protection. However, the means of disconnect are considered service equipment and must be installed in accordance with requirements for service entrance conductors. Based on the requirement to provide service equipment, the transfer switch must comply with 230.90 which requires, that each ungrounded service conductor have overcurrent protection. Section 230.70 requires means to disconnect all conductors in a building or other structure from the service-entrance conductors. Section 230.66 also requires service equipment rated 600 volts or less to be marked and identified as being "suitable for use as service equipment" (service rated). Since the disconnecting means and overcurrent protection in the transfer switch is now the service disconnect, the provisions of Article 250 require that the system grounding specified in 250.24 be done at any accessible point from the load end of the service drop to the service disconnecting means which is now in the transfer switch. The connection of the grounded service conductor to the grounding electrode conductor is required to be relocated from the existing panelboard and placed in the transfer switch enclosure that is identified as "suitable for use as service equipment", based on Section 250.24. If the grounding connection remains within the existing panelboard enclosure, it would create an inability to comply with 250.24(A)(5).

29. Our manufacturing facility is considering replacing existing switches with circuit breakers to control luminaires. Are circuit breakers capable of providing the appropriate means of control for lighting circuits? Would the circuit breaker be suitable for switching fluorescent and high-intensity discharge luminaires on the same branch-circuit?

ANS: Circuit breakers used as switches for luminaires shall comply with the applicable provisions of Article 404 and 410. Section 404.11 permits a circuit breaker to serve as a switching device. In addition Section 240.83(D) requires that circuit breakers used to switch 120-volt or 277-volt fluorescent lighting circuits be listed and marked "SWD" (switching duty) or "HID" (high-intensity discharge) on the circuit breaker. Circuit breakers marked "SWD" are rated either 15 or 20 amperes and are intended to switch only fluorescent lighting loads. High-intensity discharge lighting circuit breakers are heavier duty in order to dissipate the increased heat from greater current flow during the intense ignition period of the luminaire. HID circuit breakers are also available in more than the two standard ampere ratings (rated up to 50A). Circuit breakers marked "HID" can be used for switching both high intensity discharge and fluorescent lighting loads. The NEC does not preclude these installations from being supplied by the same branch circuit.

30. Can I run nonmetallic sheathed cable diagonally and secured to the underside of the joists in an unfinished basement of a one-family dwelling?

ANS: Yes, provided it meets the requirements of NEC Section 334.15(C) which indicates that if

the cable contains two or more 6 AWG conductors or three 8 AWG conductors it may be secured to the lower edge of the joists. Smaller cables must be run through bored holes in the joists or the cable must be secured to running boards. The reasoning behind this is that the larger cables would have a better chance of survival if the cable were used to support items hung from the cable with hangars.

31. At the new clinic, there are actuators which close a damper for the return air ducts on each floor when the fire alarm system goes into alarm, there is also a fire alarm module which signals a relay and the damper then closes the flow of air in the return air duct. The actuators and dampers will close with any power outage, in other words they are operated in a fail safe mode. The Engineers have designed these damper actuators (120 volt) on the emergency system along with the exit and emergency lights, I do not believe these 120 volt actuators should be on the emergency system. I would like a clarification from you if possible.

ANS: The NEC does not address which items shall be on the emergency system or which shall have standby power. Chapter 27 of the International Building Code in Section 2702.2 Emergency and Standby Power Systems, says “Emergency and standby power shall be provided where required by Sections 2702.2.1 through 2702.2.20.” Section 2702.2.2 Smoke control systems says; “Standby power shall be provided for smoke control systems in accordance with Section 909.11.” Section 909.11, Power systems states “The smoke control system shall be supplied by two sources of power.” “Primary power shall be from the normal building power systems. Secondary power shall be from an approved standby source complying with Chapter 27 of this code.” The actuators should be installed on a Legally Required Standby System in compliance with Article 701 of the NEC.

32. I have inspected some main distribution panels (MDP's) and have found the Electrical Contractor has cut out the bottom of these MDP's and also the transfer switches, both of which sit on the floor. The equipment did not come from the manufacturer with an open bottom. I believe this is a violation of NEC 300.12, exception #2 where the commentary of the handbook only allows this to occur when the equipment is a switchboard, motor control center or transfer switch which comes from the manufacturer with an open bottom. I am referring the installer to NEC Code section 300.12 as the Code where this is not allowed, and indicating that the PVC conduits are required to be secured to the bottom of the MDP's with the proper PVC terminal adapters & locknuts. I would also look to 110.12 for an additional Code reference. Is this correct?

ANS: NEC Section 300.12 requires metal or nonmetallic raceways, cable armors, and cable sheaths to be continuous between cabinets, boxes, fittings or other enclosures or outlets. Exception No. 2 says, “Raceways and cables installed into the bottom of open bottom equipment, such as switchboards, motor control centers, and floor or pad-mounted transformers, shall not be required to be mechanically secured to the equipment.” While the statement lists the equipment you reference it could easily add panelboards, wireways and others where it uses the term “such as”. I've permitted raceways poured in concrete to be considered secured without physical connection to the bottoms or backs of enclosures with conditions. The enclosure has to be secured to and tight against the concrete the raceways pass through and each raceway contains equipment grounding that bonds to the enclosure and to the raceway if metallic. The concrete isn't going to burn and it is definitely securing the raceways.

33. Is it permitted to use the same GEC for two separate systems with two different voltages, such as a 277/480 and a 120/240 volt system?

ANS: Yes, NEC Section 250.64 Grounding Electrode Conductor Installation, in paragraph (F) says “The grounding electrode conductor shall be sized for the largest grounding electrode conductor required among all the electrodes connected to it.” The size required for each system is determined by Section 250.66 and the larger of the two would be used to make the connection. If the same electrode is not utilized the electrodes require bonding in accordance with NEC Section 250.50 Introduction.

34. I have a multi-family project where we are using Magic Packs gas heaters in the units. The units have a box at the top for connections, in which we installed the 2 pole disconnect for the equipment. The inspector is requesting us to install a remote disconnect located lower to comply with the 6'7" maximum height requirement location in Section 404.8 (A) of the NEC. I maintain that since the manufacturer installed the junction box in this location to be used for termination of the circuit that the disconnect would be accessible and following Exception No. 2 allows the disconnect switch to be installed above the 6'7" level. Who is correct?

ANS: The disconnect for an appliance required by sections 422.32 & 430.102(A) has been installed within sight from the appliance motor controller. NEC 430.107 says at least one of the disconnecting means shall be readily accessible. Since the disconnect at the appliance is located higher than 6' 7" the branch circuit breaker located in the tenant panelboard is the readily accessible disconnect. The appliance disconnect mounted at the appliance but over 6' 7" above the floor complies with 404.8(A) Exception No. 2 where "accessible by portable means" is permitted. The purpose of this disconnect is for servicing the electrical components of the appliance. This disconnect is not intended for use as an emergency shut-off (the branch circuit breaker can be used for an emergency shut-off).

35. I have a service that I need some help on. It's 480 Volt, 400 Amperes, starts outside in a CT cabinet, then to an exterior transfer switch, and terminates in an exterior panel board with 2 breakers; 1- 400A for a new well and one 200A for an old well. Then the feeders go into the building to an MCC that feeds a well and has a transformer in it for a new lighting panel. The power company had me bring the neutral conductors to the transfer switch and that is where I bonded the neutral. (The feeders are 2 sets of 3-350 kcmil CU conductors). Do I need to bring the neutral conductor from the transfer switch to the MCC? I think I do but others say the grounded conductor is not needed.

ANS: Conductors from the CT cabinet to the transfer switch mean the transfer switch is the service disconnect and has to be SE rated as well as provide overload protection or have the overload protection adjacent to it in accordance with NEC Section 230.91. From the transfer switch a feeder supplies a panelboard with 2 breakers. The grounded (neutral) conductor can stop at the service disconnect (transfer switch) and does not have to go beyond unless you are using the grounded conductor. The transformer could be a separately derived system and a grounded conductor would originate on the secondary XO terminal. This grounded conductor would be connected to a grounding electrode conductor and tied to the building electrodes used at the service as well as bonded to any metal water piping.

36. Where does it say in the NEC that derating only takes place when you exceed 30 conductors at a cross sectional area of a wireway? Section 376.22(B) says; that the adjustment factors of 310.15(B)(2)(a) shall be applied where the number of current-carrying conductors including neutral conductors classified as current-carrying exceeds 30. It does not indicate that the cross sectional area is a factor in derating only that the wireway have more than 30 current-carrying conductors.

ANS: NEC 376.22 says that the number of conductors and their ampacity shall comply with both 376.22 (A) and (B). (A) says; "The sum of the cross sectional area of all conductors at any cross section of a wireway shall not exceed 20% of the interior cross-sectional area of the wireway. (B) adds that the adjustment factors in section 310.15(B)(2)(a) shall be applied only where the number of current-carrying conductors exceeds 30. While you are correct in (B) does not mention cross-sectional area it is only common sense to consider it as an integral part of the installation. What if we installed a wireway and in one area had 29 conductors but used the wireway at the other end to access a junction box with a two-wire circuit giving us a total of 31 conductors in the wireway? Do we derate everything based on additional conductors that are six feet away and not in the cross sectional area. In order to use the section both (A) and (B) must be considered.

37. A heating contractor I do work for was told by the electrical inspector that a replacement furnace doesn't have to be on its own circuit but if it is new construction it does. What is the real code on this?

ANS: Replacement of a furnace is considered a repair and a new branch circuit is not required if the existing circuit can handle the load. If the furnace instructions require a separate circuit they must be followed. For a new installation the code requires a separate branch circuit. SPS 316.003 provides instructions on the application of rules. Generally rules are not retroactive unless specifically indicated.

38. It is my understanding that the percentages for voltage drop in NEC 210.19 (informational note 4) and in 215.2.A (informational note 2) are "suggestions" of values that will ensure, as it says, "reasonable operating efficiency" The verbiage in the Code Handbook makes it pretty clear that the values are not mandatory. The question came up at a meeting where we were discussing the input voltage requirements for LED luminaire drivers. I've been told that the drivers are quite tolerant, and I had said that we would be evaluating that, and possibly allow more discretion in voltage drop calculations in this case. What is going on here?

ANS: You are correct in that voltage drop is a consideration but the Fine Print Notes are just information and not enforceable. In the 2011 NEC they will be called Informational Notes and it is still indicated that they are not enforceable. Section 90.5 (C) of the NEC covers this. Unlike NEC 90.1, 90.2 and 90.4, Section 90.5 remains in the adoption through SPS 316.090. The only mandatory voltage drop requirements I am aware of are found in 647.4 (D) for sensitive electronic equipment and in 695.7 for Fire Pumps where it limits the voltage drop to not more than 15% below normal controller rated voltage or not more than 5% below the voltage rating of the motor operating at 115% of its FLC.

39. How do I terminate the bare aluminum ground wire in hospital-grade Armored Cable (AC)?

ANS: The internal aluminum bonding strip serves no purpose once it is outside of the cable. It can be cut off. Many electricians use it to hold the anti-short bushing in place on the cable.

40. Can we use cord drops to supply a permanently fastened in place machine?

ANS: Yes, if the machine meets any of the requirements of NEC Section 400.7 for uses permitted on flexible cords. These include frequent interchange, prevention of the transmission of noise or vibration or where required for moving parts.

41. I'm installing a large dry-type transformer separately derived system and need to verify the correct size system bonding jumper. I have 2000 kcmil copper ungrounded phase conductors for each of the three phases and the neutral of the system. (4) 500 kcmil copper conductors in parallel per phase. According to Table 250.66 can I use 3/0 copper for the system bonding jumper?

ANS: The requirements for sizing a system bonding jumper for separately derived systems are found in 250.30(A)(1) which refers to 250.28(A) through (D). Section 250.28(D)(1) addresses system bonding jumper sizes. Note that if the supply conductors are larger than 1100 kcmil copper, the system bonding jumper must be at least 12.5% of the total cm. Based on the information in the question, $2000 \times .125 = 250$ kcmil and it is the minimum size required for the system bonding jumper. Remember Table 250.66 is used to size more than just grounding electrode conductors. It is used to establish the minimum sizes for grounded conductors, supply-side bonding jumpers, main bonding jumpers, and system bonding jumpers. The 12.5% rule is in effect for all but the grounding electrode conductor.

42. I have heard the term "service receptacle" used and have not been able to find any information. Can you explain what this is and how it would be used?

ANS: A service receptacle is a receptacle installed for servicing equipment located in a position where a convenience receptacle may not be close, such as above a suspended ceiling. I could use

the term “maintenance” receptacle but either way it is not for permanent use just a convenience receptacle for temporary use.

43. I thought I read in the code that all unused equipment, conduits, wire, panels, etc., should be removed. I can't seem to find it. To me it makes sense, but is it a code requirement?
ANS: There is no specific requirement in the NEC that requires all unused equipment or wiring to be removed. Section 590.3(D) has requirements to remove temporary wiring upon completion of construction. There is a requirement in 645.5(G) for the removal of the accessible portion of abandoned supply circuits and similar requirements in 640.6(C), 372.13, 374.7 and 390.8.
44. I have had an ongoing discussion on the job about the proper use of Double Pole-Single Throw switches to switch both a 277V circuit and a 120V circuit simultaneously. Some say this is disallowed by section 404.8 B, which states that a divider is needed between adjacent devices if they exceed over 300V. I don't think this applies because there are not two devices. Others are trying to claim that 210.4 B would negate the use. This states that where a multiwire branch circuit supplies more than one device or equipment on one yoke, all circuits shall be disconnected simultaneously. I don't think this applies as it is not a multiwire branch circuit but rather two circuits. I feel that the practice may not be up to code but cannot find where it prohibits this practice.
ANS: Check out Section 404.8(C) of the NEC. A multi-pole snap switch is not permitted to be fed from more than a single circuit unless the switch is marked as a 2-circuit switch or unless its voltage rating is not less than the nominal line to line voltage of the system supplying the switch. In your description there would be two systems supplying the device. A recipe for disaster.
45. Can we use the reinforcing rods in the concrete deck around a swimming pool to bond the metal pool accessories?
ANS: Yes, Section 26 of the NEC states that the parts specified in the Section shall be bonded together. Connections may use solid copper conductors, insulated covered or bare, not smaller than #8 AWG. The parts include structural reinforcing steel, metallic components and include the pool water.
46. Is it acceptable to use a 14 AWG conductor for the bonding jumper to a receptacle on a 20A branch circuit?
ANS: No, an equipment grounding conductor of the wire type shall not be smaller than shown in Table 250.122. The sizes in the Table are based on the rating or setting of the overcurrent device in the circuit ahead of the equipment. The bonding jumper used to connect the grounding terminal of a receptacle to a metal box is sized in accordance with 250.122, based on the rating of the circuit overcurrent device ahead of the equipment or conduit.
47. Two medium voltage (15,000-volt) metal switchgear enclosures are facing each other in an electrical room. The system voltage is 12,456 volts. What is the minimum working space required between the two switchgear enclosures facing each other?
ANS: The phase-to-ground voltage of a 12,456Y system is 7200 volts. ($12456/1.73$) Using Table 110.34 and condition 3, the minimum required working space is not less than 1.8 m (6 ft). Remember, condition 3 to Table 110.34(A) addresses the possibilities of live parts on both sides of the working space (equipment facing each other with the covers off) which is the scenario presented in the question. Section 110.34(A) indicates that equipment likely to require examination, adjustment, servicing, or maintenance while energized shall have clear working space in the direction of access to live parts of the electrical equipment and shall be not less than specified in Table 110.34(A). Distances must be measured from the live parts, if such are exposed, or from the enclosure front or opening if such are enclosed.

48. Section 210.12A of the NEC says all outlets 15 and 20 amp in basically the whole house are required to have AFCI protection. Because of the word "outlets" and not "receptacle" the inspector is requiring ceiling lights to be included. Is this a wording mistake in the code? Or is there a code that I'm missing where all lighting needs AFCI protection?

ANS: No mistake and what you are missing is the reading of Section 210.12. The requirement is for the branch circuits to have AFCI protection for all outlets installed in the list of rooms or areas cited in Section 210.12(B) of the NEC. This would include ceiling lights and smoke detectors. Section 210.12(B) says: "All 120-volt, single phase, 15- and 20-ampere branch circuits supplying outlets installed in dwelling unit . . . shall be protected by a listed arc-fault circuit interrupter combination type, installed to provide protection of the branch circuit" Looking at the definitions in the NEC, an outlet is any opening, a receptacle is a device, a receptacle outlet is an opening where a receptacle has been installed and the branch circuit is the circuit conductors between the final overcurrent device protecting the circuit and the outlet(s). Outlet is defined as; "A point on the wiring system at which current is taken to supply utilization equipment." The definition includes everything such as lights, smoke alarms and receptacles.

49. Is it be permitted to supply the two small appliance branch circuits 210.52 (B)(1) with a multi-wire branch circuit, and provide the ground-fault circuit-interrupter (GFCI) protection required by 210.8(A)(6) with a double pole GFCI circuit breaker instead of GFCI devices at the counter top being served. The double pole breaker would meet the requirements of 210.4(B). If my understanding of a double pole GFCI breaker is correct, this should work. I can't find any language in the code that that does not allow this.

ANS: Yes, to my knowledge all 2-pole GFCI circuit breakers will work on either 120/240 multi-wire circuits or 240 circuits. The UL Whitebook (DKUY) Circuit Breaker and Ground-fault Circuit Interrupters. "A two-wire device is not suitable for use in a multiwire branch circuit as defined in the NEC. Some devices rated 120/240 V do not have a load neutral wire connector and are intended for 208 V or 240 V loads only." In order to use a GFCI breaker on a multiwire it must have a load neutral connection. The following is from the UL Standard 489 Circuit Breakers and says to me that a multipole GFCI breaker has to have a common trip or require special evaluation.

6.4 Circuit breaker and ground-fault circuit-interrupters

6.4.1 General

6.4.1.1 This section covers additional requirements for circuit

breakers and ground-fault circuit-interrupters that provide overcurrent protection and personnel protection against risk of electric shock as required by the National Installation Codes in Annex B, Ref. No. 1. These devices are rated Class A, single-pole, 120 V ac and/or 127 V ac, 60 Hz and 2-pole, 120/240 V ac, 60 Hz.

6.4.1.2 The ground-fault circuit-interrupter portion shall comply with the construction requirements in Annex B, Ref. No. 12 and Section 6.4 of this standard, except that printed wiring board spacings may be evaluated in accordance with 6.1.6.2.2 – 6.1.6.2.5.

6.4.2 Supervisory Circuit

6.4.2.1 If a 120/240 V circuit breaker mechanism is a common-trip type, the supervisory circuit need only be provided from one ungrounded pole. If a 2-pole circuit breaker mechanism is not a common-trip type, the need for more than one supervisory circuit shall be evaluated. I have seen farm machine sheds where contractors have chosen to install 2-pole GFCI circuit breakers on the multi-wire branch circuits used for shop receptacles. Decreases on raceway fill, reduces conductor ampacity adjustment, makes replacing worn receptacles less expensive in the future, and the GFCI testing is all at one location. If only 2-pole AFCI's were as economical as the 2-pole GFCI's!

50. Is it acceptable to install Type MC 12/2 (metal clad) cables below ceiling joists where they are stapled to the bottom of the joist?

ANS: Yes, Type MC (Metal Clad Cable) installed in accordance with Article 330 does not have the same restrictions as NM cable. Section 330.30 has the requirements for securing and supporting these cables.

51. An electrician is remodeling a motel into Community Based Residential Facility (CBRF). She is inquiring about the use of Nonmetallic Sheathed Cable (NM) as the wiring method. It is of Type V B construction. She indicated she was being told that something changed last year and another CBRF was required to remove all NM cable and install wiring in accordance with Article 517 for Healthcare. Would the NEC allow NM cable in this building?

ANS: Yes, it is a Type V building and being a CBRF it is just residential. DHS 83.50 lists the Types of construction for CBRF's. CBRF's are generally limited in the type of care provided although there are many services such as dining, laundry and medication. If the services expand to include services provided by a nursing home a change of use to the occupancy may require changing the wiring system to that of a Health Care facility.

52. How much working space is required for duct heaters that are installed in a suspended ceiling? The electrical inspector is requiring a minimum of 36 inches in front of the contactor/control equipment enclosure mounted on the side of the duct heating unit and there is only 28 inches directly in front of the enclosure to the wall.

ANS: There are specific requirements for clearances for duct heating equipment. Duct heaters are required to be located with respect to building construction and other equipment so as to permit access to the heater. Sufficient clearance shall be maintained to permit replacement of controls and heating elements and for adjusting and cleaning of controls and other parts requiring such attention in accordance with Section VI of Article 424 in the NEC. It also indicates that Section 110.26 may apply.

53. The bonding of gas piping systems which contain CSST (Corrugated Stainless Steel Tubing) to the grounding electrode system is now mandatory. The following Informational Note is contained in the 2011 NEC, Section 250.104 Bonding of Piping Systems and Exposed Structural Steel. Informational Note No. 1: Bonding all piping and metal air ducts within the premises will provide additional safety. Informational Note No. 2: Additional information for gas piping systems can be found in Section 7.13 of NFPA 54- 2009, National Fuel Gas Code. Is Informational Note 1 really true given the possibility of turning the gas piping system in the street into a neutral conductor as happens with water pipes which are part of the grounding electrode system?

ANS: Underground gas piping systems are not permitted as grounding electrodes per NEC 250.52(B)(1). NFPA 54 also prohibits this. Gas utilities typically isolate the underground portion of the system from the above ground portions (in the buildings) using a dielectric fitting. Many gas company regulations include this as a mandatory requirement. When an underground gas piping system is on private property, the NEC requirements still apply, so the isolation must be accomplished. Section 250.104(B) covers bonding requirements for metal piping systems, including metal gas piping. Informational Note No. 1 is not a mandatory requirement.

54. NEC Section 210.8 states items in 210.8 A through C shall be GFCI protected and the GFCI shall be installed in a readily accessible location. There are other areas of the code that require GFCI protection and do not state "readily accessible" and they are not listed in Section 210.8 (A) through (C). As an example: 422.51 vending machines installed indoors and 422.52 electric water fountains, . Section 680.71 for hydromassage tub receptacles does state readily accessible. I believe it is a good idea and perhaps an oversight that the code will catch up with but as inspectors we should stand by the verbiage of the code. Does a vending machine or an electric water fountain, installed indoors and not within 6' from a sink or in a commercial kitchen require that the GFCI receptacle be "readily accessible?"

ANS: The intent is that a GFCI type receptacle or device be readily accessible. The manufacturer's instructions require that these receptacles be periodically tested and being readily accessible is required. Section 110.3(B) of the NEC may be cited.

55. For all I know with regards to the correct size of conductors on any unit (e.g. RTU's, VAV's, AHU's), the nameplate rating shall be followed or the specs (whichever conductor is bigger). In other words, this (nameplate) over ruled any addition to size of conductor. So, if the unit calls for 58.5 amperes, then you need to use next standard size OCPD (which is 60 amperes), therefore, #6 Cu is acceptable. If for some reason the engineer wrote down #4 Cu on specs, then it shall be followed. Electrician's at jobsite don't usually compute for any discrepancies. Most of the time, whatever is written on specifications or the nameplate is always followed.

ANS: The motor nameplate shows 58.5 amperes. However 430.6(A)(1) requires that Table 430.250 be used for determining the motor full load current (FLC) rating for three-phase AC motors instead of the actual motor nameplate FLC rating. Table 430.250 shows a full load current rating for a 50-hp, 460-volt motor to be 65A. The reason for using the FLC ratings shown in Table 430.250 is that the actual full load current rating for motors of the same horsepower may vary and requiring the use of the table ensures that if a motor must be replaced, this can be accomplished without making changes to other component parts of the circuit. NEC 430.22 requires that the conductors supplying a single motor must have an ampacity not less than 125 percent of the motor full load current as determined by Table 430.250. Multiplying 65 x 1.25 = 81.25 and as shown in Table 310.15(B)(16) this requires a 4 AWG cu conductor.

56. Does a motor disconnect require the working clearance of Section 110.26 of the NEC or 3 feet minimum?

ANS: That depends on whether the equipment needs examination, adjustment or servicing while energized. If it requires any of those items the workspace is required. Generally if there are overcurrent devices in the disconnect the workspace is required.

57. Manufacturer's provide labels inside packages containing ground-fault circuit-interrupter receptacles and recommendations to place them on protected receptacles downstream from the device. Where are these labels required to be used?

ANS: SPS 316.110 (1) says: "*Listed or labeled equipment shall be installed or used, or both, in accordance with any instructions included in the listing or labeling, provided the instructions, listing or labeling do not conflict with this chapter.*" Barring any specifics in the listing or labeling other than the manufacturer's recommendations the use of these labels is specified in NEC Section 406.3 (D) Replacements. It states that "Replacement of receptacles shall conform with 403.3 (D)(1), (D)(2), and (D)(3) as applicable." It is paren. (3) that has a requirement for the use of these labels. (3)(b) states: "A non-grounding-type receptacle(s) shall be permitted to be replaced with a ground-fault circuit interrupter type of receptacle(s). These receptacles shall be marked "No Equipment Ground." An equipment grounding conductor shall not be connected from the ground-fault circuit interrupter-type receptacle to any outlet supplied from the ground-fault circuit-interrupter receptacle." (3)(c) adds: "A non-grounding-type receptacle(s) shall be permitted to be replaced with a grounding-type receptacle(s) where supplied through a ground-fault circuit-interrupter. Grounding-type receptacles supplied through the ground-fault circuit interrupter shall be marked "GFCI Protected" and "No Equipment Ground." An equipment grounding conductor shall not be connected between the grounding-type receptacles." The labels are not intended to be used on new construction to identify GFCI protected receptacles although they may be; but not in my house.

58. Is 3/0 AWG 600 volt welding cable suitable as conductor feeds for a continuous duty disconnect that feeds the normal side of an automatic transfer switch? I am unable to find the specs/parameters for welding cable in the code.

ANS: Listed welding cable is intended for use as the secondary conductors of electric welders and unless also marked as one of the other types of wire shown in Table 310.104 generally cannot be used as building wire. Welding cable is very finely stranded and if used must be used with listed terminals for this application.

59. I have an electrician that ties all the neutral into pairs with a wire twist nut and pig tails out to the neutral bar. My understanding is that unless he balances the disconnect placement with one disconnect on L1 and the other on L2 on two 20 amp disconnects he can produce 40 amps on the number 12 neutral wire. Where can I find and read about this in the NEC code book?

ANS: Your reference is to three wire circuits where the neutral conductor is shared. Checkout the definition in Article 100 of Branch Circuit, Multiwire where it shows two or more ungrounded conductors with a voltage between them and a grounded conductor that has an equal voltage between it and each ungrounded conductor of the circuit. If the two circuit conductors are placed on the same phase the neutral conductor which they are sharing will carry the full load of both conductors rather than just the unbalanced load. So your second statement is correct. The other part of your question where the installer is splicing neutrals together and pigtailing onto the neutral is not in conformance with 408.41 where it is required that each grounded conductor must terminate in an individual terminal that is not also used by another conductor.

60. Is GFCI protection required for receptacles located in a walk-in cooler at a restaurant?

ANS: A walk-in cooler may be a part of the kitchen area and GFCI protection would be required.

61. In the code it does not state the supporting requirements and spacing of such supports for type UF cable. I understand that UF is similar in definition to NM cable, and it may be safe to follow the NM ruling. However, the code is silent on this issue. Is there some standard for the support of UF cable?

ANS: NEC Section 340.10(4) refers to Parts II and III of Article 334. Generally where UF cable requires supporting it is being used in place of NM cable and the requirements can be found in Section 334.15 of the NEC.

62. The second sentence in section 450.24 Nonflammable Fluid-Insulated Transformers states, "Such transformers installed indoors and rated over 35,000 volts shall be installed in a vault." The third sentence states, "Such transformers installed indoors shall be furnished with a liquid confinement area and a pressure-relief vent." The question is does the third sentence apply to all Nonflammable Fluid- Insulated Transformers installed indoors, or just the ones that are rated over 35,000 volts?

ANS: I believe the requirement is for all fluid-insulated transformers installed indoors to be furnished with a liquid confinement area and a pressure-relief vent.

63. Elevator direction indicators at a landing (28 volts DC) are being relocated by extending the flexible metal conduit. An electrical inspector told an elevator mechanic they cannot have a 90 degree elbow concealed in a wall. The elbow was used just for pulling, and does not contain wire nuts or splices. Is the inspector correct?

ANS: Yes, Section 348.42 of the NEC states: "Angle connectors shall not be used for concealed raceway installations. Angle connectors such as 45 and 90 degree connectors for flexible metal conduit (raceways) have a removable section to allow conductors to be installed. That removable section has to be accessible in order to pull (install or replace) conductors. They are not intended to be concealed. "

64. When the NEC adds locations for GFCI protection do we have to change the receptacles?

ANS: No, the NEC is not retroactive and there is no requirement to update installations unless stated so. If the receptacles were changed or replaced in locations where GFCI protection is now required, Section 406.3(D)(2) of the NEC would require the replacements to be GFCI protected.

65. When I use stranded conductors, can I use a fork-style crimp (spade) connector for terminating conductors on a device such as a switch or receptacle so the strands don't creep out from under the screw? An inspector requires this and I read somewhere that the devices are not listed for use with these types of connections.

ANS: The NEC is silent on the issue except what is covered by 110.3(B) for listed products. As I understand it, the crimp style fork (spade) connectors are listed and the devices are listed, but I don't believe that the nationally recognized testing labs evaluate this type of connection to a device.

66. I have a question related to the receptacle outlet for a vending machine installed outdoors at a commercial building. I know that older vending machines manufactured or remanufactured prior to January 1, 2005 that do not have GFCI protection integral to the cord and plug, are required to be connected to a GFCI-protected outlet. My question is this; is a receptacle GFCI (outlet type) required to be readily accessible in accordance with 210.8(A)(4)? The vending machine is covering the wall-mounted receptacle.

ANS: Yes, Section 210.8(A)(4) is an outdoor receptacle and does apply to the receptacle outlet as described in the question. The definition of readily accessible in Article 100 makes it clear that there should not be obstacles that prevent ready access.

67. Is there any limitation for lighting branch circuit sizes where conductors are sized to match the overcurrent device? Most HID hi-bay and site lighting circuits are 30amp and fluorescent lighting circuits are 20amp. We are changing warehouse HID fixtures on a 30amp circuit with new fluorescent hi-bay fixtures. I don't see any amperage limitations with the fixture listings. Am I missing anything or is it acceptable to install these fluorescent fixtures on a 30amp circuit without any individual fixture overcurrent?

ANS: Branch circuits rated at 30-amperes are permitted to supply fixed lighting units with heavy duty lampholders in accordance with NEC 210.23(B). The fluorescent fixtures are limited to 15 or 20-ampere circuits in accordance with 210.23(A).

68. We have issues with connecting power and working on duct heaters above suspended ceilings. Is there any where in the Code that addresses these?

ANS: Yes, Section 424.66 of the NEC provides requirements for installations of duct heaters. It also guides the Code user to Section 110.26 for minimum safe working clearance in front of the control panel enclosing energized parts requiring examination or servicing while energized. This is an area where more education efforts are needed, particularly with the HVAC profession, who need to be aware of this NEC requirement when they select a location, and install the duct heater. You can also refer to the NFPA standards found in the Note to 424.66.

69. Do the raceway fill rules apply to communication wires? What about the requirements for pull and junction boxes?

ANS: No, Section 800.110 of the NEC says that "The raceway fill tables of Chapter 3 and Chapter 9 shall not apply. As for junction and pull boxes Section 800.110 says: "where communication wires and cables are installed in a raceway, the raceway shall be either of a type permitted in Chapter 3 and installed in accordance with Chapter 3 or listed plenum communications raceway, listed riser communications raceway, or listed general-purpose communications raceway installed in accordance with 800.154," This indicates that compliance with requirements of Article 314 would be required unless exempted.

70. A student recently brought up a question in regards to placing a metal junction box in a wood construction stud cavity used for return air. The question was whether it is code compliant or not. I referred to section 300.22(C)(3). After reading the article I think I may have confused myself. See I was under the understanding that you were not allowed to put any box in a return air of this style unless it was rated for the application and used for HVAC equipment. Art. 300.22(C)(3) states that electrical equipment with a metal enclosure, or nonmetallic enclosure listed for use within an air-handling space, can be used in a air-handling space. Does a metallic box with switches or outlets fit the definition of electrical equipment with a metal enclosure?

ANS: The answer to your question is yes. The question on use of the space in a return air duct or

as the NEC uses the term "Other Space Used for Environmental Air" for a metal junction, switch or outlet box has been around for some time. A metal box or nonmetallic enclosure listed for the purpose can be installed in the "other space" provided the area for the environmental air or other purpose is not reduced beyond the design criteria. Any conductors entering would have to be in a wiring method in compliance with 300.22 (C) (1) and the use of a metallic box or nonmetallic enclosure listed for the purpose in compliance with 300.22 (C)(2) would be required. If the box were used in a dwelling unit application, the exception would prevent nonmetallic sheathed cables from terminating since the exception says they must pass through the space. The general rule does not prohibit the installation suggested where the box and wiring methods are in compliance 300.22 (C). NM cable may be sleeved in a metal raceway to terminate at a switch or receptacle in a metal box within the other space used for environmental air. The next question will be the small holes in a metal box and do they count? The answer is no. The key issue is whether the installation reduces the area of the other space. If I were to install a 3 or 4 gang box in a stud cavity that is 14.5 inches wide and 3.5 inches deep I would be using up 21 or 28 inches of the 50.75 square inches available for air flow thus reducing the area 50%. If I only install a single device it takes 7 inches or about 1/7 of the area and may not be a problem.

71. For a single family home, what is the minimum size service disconnect required? My inspector says I have to install at least a 100-ampere service. Is this correct, even if there is little or no load? The home is 1650 square feet and has all gas appliances except a washer.

ANS: The minimum size for a one-family dwelling is specified in NEC Section 230.79 (C) where it indicates the rating shall not be less than 100 amperes, 3- wire.

72. Upon inspecting some older electrical permits I inherited from other inspectors districts some interesting wiring techniques were revealed for a multifamily building (4 family with a public meter and panel). This contractor used a 1 1/4" EMT from one existing service and distribution area to an adjacent wall where they installed (5) 100A service panels as a service upgrade to the building. Utilizing a single raceway, they connected the old system to one of the apartment panels enclosing the 24 current carrying conductors along with their respective grounded conductors ranging from #8s to #14 copper conductors. The length of the raceway is approximately 48". It is my understanding that COMM16.310 applies to an INDIVIDUAL dwelling's conductors as stated. This installation involves 4 apartments and the public area branch circuits in the same raceway. I don't believe this is a proper installation. What is your take on this particular situation?

ANS: You are correct in that the Exception No. 6 in SPS 316.310 applies to a single dwellings branch circuits. It is the intent of Comm 316.310 to apply only where the raceway contains branch circuits supplying one dwelling unit? The raceways in question contains branch circuit conductors that supply multiple dwelling units.

73. Where in the NEC does it indicate how far a light switch needs to be located away from a bathtub or shower? In a remodeled building they have a switch only separated from the shower by the shower curtain.

ANS: Switches can be located next to but not within a bathtub or shower space. Sections 404.04, 680.70 and 680.72 have these requirements. A curtain could certainly delineate the space.

74. We had a final inspection on a single family home. The inspector failed the installation for having exposed wiring in the unfinished areas of the basement. The inspector is saying that we can't install NM Cable running parallel to and stapled to a stud, with one side of the stud drywalled and the other side open in the unfinished area. The inspector is stating that the romex is subject to physical damage and that the unfinished area walls should be drywalled. Can I have a clarification on this? There is a area of the wall that the electrician did install romex horizontally thru a studded wall that has one side drywalled and the other side open in the unfinished area. I know that this is a code violation, but the wire running horizontal is drilled over 9'-6" from the floor. The basement has a ten foot ceiling. At this point wouldn't you call this inaccessible or

should I cover the NM Cable?

ANS: Nonmetallic sheathed cable that is fastened parallel to studs must be 1 1/4 inches back from the face in accordance with Section 300.4 (D) of the NEC. If it is fastened in this manner it is not considered subject to physical damage. If the NM Cable is perpendicular to the studs it may be considered subject to physical damage where it is less than 7 feet from the floor. This is supported by NEC 334.20 where it says "The installation of cable in accessible attics or roof spaces shall also comply with 320.23. Section 320.23 says "Where run across the top of floor joists or within 7 feet of floor or floor joists across the face of rafters or studding, in attics and roof spaces that are accessible, the cable shall be protected by substantial guard strips that are at least as high as the cable. This language although applied to accessible attics is a reasonable guide for the possibility of physical damage for exposed wiring. If the cable closely follows the building surface as in parallel to studs, 1 1/4 inch from the surface and crosses them at a height of more than 7 feet from the floor it should not be in a position to suffer physical damage.

75. What is the Code requirement for bonding corrugated stainless steel tubing (CSST) gas piping systems?

ANS: According to Section 205.104(B) of the NEC, metal-piping systems such as sprinkler, gas, or air that are likely to become energized must be bonded. The equipment grounding conductor for the circuit that's likely to energize the piping can serve as the bonding means. An Informational Note to this section advises that bonding all piping and metal air ducts within the premises will provide additional safety. Another new Informational Note refers to The National Fuel Gas Code, NFPA 54, Sec. 7.13, for further information about bonding gas piping, which includes the bonding of CSST. However, as noted in 90.5(C), Informational Notes in the NEC are for information purposes only and aren't enforceable as a requirement of the Code.

76. Are lighting outlets in dwelling units allowed on the same circuit as receptacle outlets?

ANS: Section 210.23 of the NEC states: an individual branch circuit is permitted to supply any load for which it's rated, but in no case is the load permitted to exceed the branch circuit ampere rating. Branch circuits rated 15A or 20A supplying two or more outlets must only supply loads in accordance with 210.23(A), which says that a 15A or 20A branch circuit is permitted to supply lighting, equipment, or any combination of both. Except for temporary installations [590.4(D)], 15A or 20A circuits can be used to supply both lighting and receptacles on the same circuit. Cord- and plug-connected equipment not fastened in place, such as a drill press or table saw, must not have an ampere rating more than 80% of the branch circuit rating in accordance with Section 210.23(A)(1). Equipment fastened in place (other than luminaires) must not be rated more than 50% of the branch circuit ampere rating if this circuit supplies luminaires, receptacles, or both in accordance with Section 210.23(A)(2).

77. We installed a 1200 Ampere, 480 Volt panel with a front workspace of 3 1/2 feet to a concrete wall. The inspector says we need 7 feet of workspace. Is she correct?

ANS: The workspace is measured from the enclosure face or front. 3 1/2 feet is required by Table 110.26(A)(1) as a minimum based on your description. Since the equipment is 1200 Amperes and assuming it is more than 6 feet in width, an entrance at each end of the workspace is required. One entrance/exit is permitted if the location permits a continuous and unobstructed way of egress travel or the required depth of the workspace is doubled to the 7 feet you mention.

78. Are you required to bond isolated sections of metal water pipe that are connected to a nonmetallic water piping system?

ANS: No, an isolated section of metal pipe is not a metal water piping system. A metal water piping system must be bonded as required in 250.104(A)(1), (A)(2), or (A)(3). The bonding jumper must be copper where it is within 18 in. of the earth [250.64(A)], securely fastened to the surface on which it's mounted in accordance with Section 250.64(B), and adequately protected if

exposed to physical damage. In addition, all points of attachment must be accessible complying with Section 250.104(A).

79. Is an over-counter light in a dwelling unit kitchen allowed to be hardwired to the small-appliance circuit?

ANS: No: the 20Ampere, 120 Volt small-appliance circuits required by 210.11(C)(1) may only supply receptacle outlets in accordance with Section 210.52(B). There are Exceptions for a clock outlet and power for supplemental equipment for gas-fired appliances in the areas listed.

80. What is the Code requirement for the emergency shutoff for spas and hot tubs?

ANS: Section 680.41 of the NEC says, "A clearly labeled emergency shutoff or control switch for the purpose of stopping the motor(s) that provide power to the recirculation system and jet system shall be installed at a point readily accessible to the users and not less than 1.5 m (5 ft) away, adjacent to, and within sight of the spa or hot tub. This requirement shall not apply to single family dwellings." Either the maintenance disconnecting means required by 680.12 or a pushbutton that controls a relay located in accordance with this section can be used to meet the emergency shutoff requirement. The purpose of the emergency shutoff is to protect users. Deaths and injuries have occurred in less than 3 ft of water because individuals became stuck to the water intake opening. This requirement applies to spas and hot tubs installed indoors as well as outdoors.

81. Does the NEC require a meg-ohm test on installed feeder conductors prior to energizing them? The job specs require this but I can't seem to find a Code rule that supports it.

ANS: The NEC does not have a specific rule that requires a meg-ohm test on feeder conductors or for that matter any conductors prior to energizing them. However, Section 110.7 does require that "Completed wiring installations shall be free from short circuits, ground faults or any connections to ground, other than as required or permitted elsewhere in this code. There are standards that address requirements for testing electrical conductors. Many electrical workers use a meg-ohm meter to verify compliance with 110.7 prior to energizing the circuits connected to the system. If you have ever witnessed the energizing of a bolted fault, a simple test can save a great deal of time,

82. When starting the design of this nursing home project, the owner requested we place the laundry loads and freezer/refrigerator loads on the generator. They requested those loads because a few years back severe weather caused a power outage lasting two days. During that time they had a very hard time with maintaining sanitary linens because there are no facilities nearby that have commercial laundry machines and food that needed to be kept cold had to be moved to preserve it. After that incident the Owner now knows those loads are essential to have an effective operation of their institution. Those loads are the only loads on the essential electrical system that are not specifically called out in 517.43 but we consider those loads to fall under section 517.43 (B)(3). So per FPN Figure 517.41 No. 2 we designed the system with one transfer switch because the demand on the essential electrical system was 150kva or less.

ANS: After reviewing the codes and a discussion with (DHS, Office of Plan Review and Inspection) we came to the determination that the loads described would not qualify as Critical Branch loads according to NFPA 99, 1999 edition 3-4.2.2.2 (c) 9 which states; "Additional task illumination, receptacles, and selected power circuits needed for effective facility operation. Single-phase fractional horsepower motors shall be permitted to be connected to the critical branch." The described loads can be added to the system however they belong in the Equipment system, a quick look through NFPA 99, 1999 edition 3-4.2.2.3 shows these loads more in line with the loads described there-in, which include heating, elevators and ventilation just to name a few. Since the loads are not in the critical branch or the life safety branch they do not qualify as emergency loads. Article 700 Emergency Systems, 700.6 Transfer Equipment (D) (2008 Ed-NEC) states; "Transfer equipment shall supply only emergency loads." Since the loads are not

emergency loads these are Article 702 Optional Standby Systems or NFPA 99, 1999 edition 3-4.2.2.3 Equipment System loads. If added to the system they would require a separate transfer switch, because of Article 700.6 (D) (2008 Ed-NEC), even though the system is under 150kVa and meets other exceptions listed in the codes.

83. Is a circuit breaker of a permanently installed outdoor (optional) standby generator considered readily accessible when located within the locked generator enclosure?

ANS: The definition says the specified equipment (disconnect) is to be visible. Section 702.8 requires signage at the service disconnect telling you where the generator disconnect is and another sign on the generator housing can tell you the location of the disconnect within the enclosure (so you know which door to open). Open the generator disconnect access cover and the disconnect is now visible from the building. What is implied is that a circuit breaker located behind the cover of a panelboard is not acceptable as a disconnect where a disconnect is required to be within sight from a certain appliance. So the circuit breaker located in a common residential panelboard can't legally be used for the adjacent electric water heater disconnecting means because it isn't visible from the water heater when the panel cover is closed. I don't think the person responding for NFPA thought their answer through. Standing at the water heater I can see the circuit breaker but when I turn and face the water heater to service it I can no longer see the circuit breaker. That's why we have a lock-out tag-out program! My position is if the disconnecting means is within sight of the building, with the door or access hatch open, the installation can be approved without another disconnecting means at the building. Section 702.12 requires a generator set equipped with a readily accessible disconnecting means located within sight of the building or structure supplied. In sight [from] is defined in Article 100 as being visible and not more than 15m (50 ft) distant from the other. Thus, if the means of disconnect on the generator is not visible it is not in sight. The definition of readily accessible does not preclude the use of a lock for electrical equipment nor rooms containing electrical equipment.

84. Will a Mobile Home installer (assume the firm has a License as a manufactured Home Installer) be able to connect the service entrance conductors from an existing manufactured home community site when a home on an existing site is changed out, after 4/1/13? The conductors were used for the previous home on the site and they are the proper size for the service of the new manufactured home.

ANS: The language in the law would treat a manufactured home like a piece of equipment under the new electrician licensing exemptions. The manufactured home installer would be allowed to make the final connection of the feeder supplying the home from an existing disconnecting means or junction box (which ever is closer to the home) without having to be licensed as an electrician. The installation is still subject to permit and inspection requirements and is required to comply with the electrical code.

85. I have a question in regards to the application of the requirements for installing an equipment grounding conductor in flexible metal conduit in accordance with Section 348.60 of the NEC. I understand the State of Wisconsin requires the equipment grounding conductor to be installed in all flexible conduit, as if the flexible conduit is installed, it is installed for flexibility. I have UL "listed" light fixture whips, with internal flexible connectors (connectors screw internal to 3/8 flexible conduit), which have no equipment grounding conductor. Per SPS 316.110, listed products must comply with the requirements in SPS 316 and the NEC, therefore I am assuming I would be within my right to require an equipment grounding conductor to be added to this listed fixture whip. I have called UL and they are OK with this listed fixture whip without an equipment grounding conductor per the language in the UL White book category "DWTT".

ANS: I assume these whips are not listed as part of a luminaire assembly but rather they are listed whips for use with any luminaire and are field installed. Wisconsin's language in SPS 316.110(1) requires compliance with the NEC beyond what the listing approves. NEC 250.118(6)e. requires an equipment grounding conductor to be installed. I would require the addition of an equipment

grounding conductor. I agree, in 250.118 (5) d. the language for flexible metal conduit requires an equipment ground where used for flexibility. If flexible metal tubing (7) was used it does not have similar language. AC and MC cables are additional options.

86. In the 2008 edition of the NEC®, Section 410.10(E) requires lamp protection for mercury vapor or metal halide type fixtures in indoor sports, mixed-use, or all-purpose facilities. Is this requirement applicable to a 65,000 square foot sporting goods retail facility? Does the requirement apply if the store contains a practice area, such as a batting cage or an indoor golf range?

ANS: No, the requirement in the NEC would not apply to a retail establishment such as a sporting goods store. The requirement would apply to that portion that is designated to be used as an indoor sport area such as the driving range or batting cage. Given the problems with these amps the owner may wish to use Section(s)410.11 or 410.12 and install guards or lenses on the fixtures.

87. A swimming pool installed at a single-family dwelling has several motors, as well as other loads associated with it, and a panel in a NEMA 3R enclosure is installed on posts near the pool equipment to serve these loads. An inspector has called this a separate structure and is requiring a main breaker in the pool panel. Are the posts that the pool panel is mounted to considered to be a structure?

ANS: The posts that the panel is mounted to are a structure. The NEC defines a structure as that which is built or constructed and the building code uses identical language. The panel is a feeder and based on the requirements of NEC Section 225.31 a means to disconnect all ungrounded conductors that supply or pass through the structure shall be provided. Section 225.33 allows up to six switches or circuit breakers for this purpose. Section 408.36 of the NEC requires that the panelboard have overcurrent protection ahead of or within the panelboard with a rating not exceeding that of the panelboard.

88. Is there a Code requirement to provide ground-fault circuit-interrupter (GFCI) protection for luminaires in a bathroom? This question has come up in a nursing home facility. The bathrooms in question are in the patient units, and there are two luminaires in each bathroom: one over the sink and one in the shower area.

ANS: The requirements in Section 210.8 of the NEC do not apply to luminaires. It is specific in that GFCI protection is provided for personnel by protecting all 125-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified.

89. Does the NEC® include requirements on the proper design of drop lights or trouble lights? More specifically, are there applications for which the NEC prohibits incorporating a receptacle in the handle of a drop light?

ANS: The NEC does not really address portable luminaires. Information on them can be found in the UL Guide (QOWZ) where it references UL 153 Portable Electric Luminaires. In UL 153 it says in Section 43.1 A convenience receptacle provided on a portable luminaire shall be of the same type and configuration as the attachment plug of the unit, and shall be wired such that it provides the same polarized supply as the attachment plug of the unit. 43.2 A portable luminaire shall not be provided with more than two single or one duplex receptacle. The electrical rating shall be marked in accordance with 169.6.3.

90. We have a industrial account that is looking at adding on to their building. We will be coming into the building underground below the concrete floor with 3000-ampere 277/480 volt service conductors to free standing gear rated at 3000-amps. We need to go back under the concrete 200' to the existing 3000-ampere 277/480 volt service gear. (2 years old) and we will install an additional I-Line panel next to it. To feed the original service can we install a tap section rated at 3000-amps and install the proper size wire and feed the old service without another breaker at that point?

ANS: Yes, you are installing a 3000 Ampere service and the appropriate disconnect. From there you go to a tap section (splice section) and install conductors to the existing 3000 A switchgear. If these conductors are rated for 3000 Amperes it is not a tap since they are protected at or below their ampacity. The I-Line distribution may be a tap unless it is rated for the full 3000 Amperes. If it is rated 3000 Amperes, it is also protected at or below its ampacity and there is no issue. If the I Line is rated less than 3000 Amperes, it is a tap and the rules in 240.21 (B) (1) or (2) would apply depending on the length of the tap conductors. If the tap is less than 10 feet and at the 10X Amperes allowed you could have a 300 A minimum I-Line panel as the tap. If you use the 25 foot tap rule the I-Line would need to be rated 3X or 1000A minimum. The set of conductors feeding the existing circuit is not a tap (it originates in a splice box) if they are rated 3000 Amperes or more.

91. Are countertop duplex receptacles installed in a dwelling unit kitchen required to be split-wired?

ANS: No, they are not required to be split-wired but they are permitted to be split-wired. If they are split-wired, Section 210-4(b) must be followed and the two receptacles on the same yoke wired on a multi-wire circuit must be provided with a means to disconnect simultaneously all ungrounded conductors in the panelboard where the multi-wire circuit originated. The purpose for this requirement is to protect someone working on a receptacle outlet that might disconnect one circuit not knowing that there are two circuits present at the outlet.

92. Are all receptacles installed in patient rooms of a hospital required to be listed hospital grade?

Our inspector is requiring this.

ANS: No, based on the information in the question, all receptacles in a general care patient room are not required to be listed hospital grade types. The receptacles that are installed at the "patient bed location" of the room are required to be listed as hospital grade. There is a helpful definition in 517.2 of the term "patient bed location." This should provide additional clarity on the minimum requirements in the NEC regarding this issue. Remember that an engineer's or owner's specification may be more restrictive than the NEC minimums. In these cases, the specifications typically take priority and need to be complied with. Also the authority having jurisdiction (AHJ) has the responsibility for interpretations and approvals of electrical installations as provided in 90.4. Does the flat screen TV require a hospital grade receptacle?

93. Can you tell us what products, if any, are "identified for minimizing the passage of gasses or vapors"? I know that a lot of installers use a standard seal fitting but fill it with duct seal to accomplish this.

ANS: I am not familiar with any products identified for minimizing the passage of gasses or vapors but the AHJ has the authority to accept a product used for a specific application and my experience is that duct seal has been generally accepted.

94. I am looking for some information for a customer on panel locations. I have a building built in February 1967 and all electrical panels in the apartments are in the clothes closets. What we are looking for is the required panel clear working space at that time and if the panels could be installed in a clothes closet?

ANS: Looking back, the 1964 Wisconsin State code took effect May 1, 1964 and remained in place until 1968. At that time it was a rewrite of the NEC and we were part of the Industrial Commission. E 240.16 Location in premises. said: "Overcurrent devices shall be located where they will be: Readily accessible, except as provided in sections E 230.091 and E230.092 for service equipment, E 364.11 for busways, and E 610.42 for cranes and hoists. See section E 195.21. (2) Not exposed to physical damage. (3) Not in the vicinity of easily ignitable material. The language was the same in the NEC until the 1981 Edition adopted November 1, 1984. Where it says in: 240.24 (D) "Overcurrent devices shall not be located in the vicinity of easily ignitable material such as in clothes closets. Clearance in the 1964 code was in section E 195.15 (1) (c) "For parts of 150 volts or less to ground on one side of the working space and no bare or live or

grounded parts on the other side of the working space, 1 1/2 feet." It went up to 2 1/2 feet if the other side had bare or grounded parts. In an existing installation in a closet I would go with the 18 inches at the time. It also adds that working space shall not be used for storage.

95. In wood framed buildings with metal studs and steel beams, does the metal or steel need to be bonded or grounded?

ANS: There are no requirements in the NEC to bond metal studs or remote steel materials to the electric supply source. NEC 250.4(4) requires electrically conductive materials that are likely to become energized to be connected together and to the electric supply source in a manner that establishes an effective ground-fault current path. Unless there is some substantiation that these metal materials are likely to become energized it is not necessary to connect them to establish an effective ground-fault path.

96. I have a 400 HP, 460V motor. How do I size and protect the motor branch-circuit conductors?

ANS: To determine the size of the motor branch-circuit conductors you use NEC Section 430.22 which requires that the conductors must have an ampacity of not less than 125 per cent of the motor full load current as determined by Table 430.250. The Table indicates a full load current of 477A for a 460 volt motor. This requires conductors with an ampacity of not less than $477 \times 1.25 = 596A$. The overcurrent protection for these conductors must be provided according to 430.52. If you are using an inverse time breaker the maximum rating would be 250 percent of the full load current or $477 \times 2.5 = 1192A$ which can be modified using Exception No. 1 to 430.52 to a rating of 1200A.

97. Is it permissible by Code to install a 10 AWG copper, bare, solid wire in electrical metallic tubing as an equipment grounding conductor?. The tubing is installed on the exterior of a building and there are no conductor fill issues.

ANS: Equipment grounding conductors are permitted to be insulated, covered, or bare. Section 250.118(1), reads as follows: The equipment grounding conductor run with or enclosing the circuit conductors shall be one or more or a combination of the following: (1) A copper, aluminum, or copper-clad aluminum conductor. This conductor shall be solid or stranded; insulated, covered, or bare; and in the form of a wire or a busbar of any shape.

98. We have been told that it is acceptable to add a receptacle with a GFCI device on the outside of a house where it is fed from the separate dining room receptacle circuit. Is this true? My competitor says they do it all the time.

ANS: No, the dining room receptacles must be supplied from the two or more small-appliance branch circuits required in Section 210.52 and Section 210.52 (B) (2) says "The two or more small-appliance branch circuits shall have no other outlets." There are exceptions for an electric clock in the rooms served as well as ignition on gas fired cooking appliances. This requirement first appeared in Section 210.52 in the 1990 NEC and prior was in Section 220-3 (b) of the NEC since the 1971 Edition and possibly earlier. You may be confusing this with what was a common installation practice of placing the outside receptacles on the GFCI protected bathroom receptacle circuit. This has not been allowed since the 1999 edition of the NEC when bathroom branch circuits were added to Section 210-11.

99. I'm inspecting a cabin. The electrician will be installing a receptacle outlet on the front of the cabin. Article 210.52(E)(1) of the 2008 requires at least one receptacle outlet be installed at the front and at the back of a one- and two- family dwelling. The homeowner would like the receptacle outlet that is required at the back of the dwelling be placed on the side of the dwelling. The electrician proposes to install the receptacle outlet on the side of the dwelling, behind a line/plane drawn through the mid-point of the side dwelling, on the rear half of the side of the cabin. Will the location of this receptacle outlet meet the requirement for having a receptacle outlet located on the back of the dwelling?

ANS: This would be acceptable. Section 210.52(E)(1) requires an outdoor receptacle be located at the front and back of the dwelling. It does not indicate it is required on the front or back wall and I would accept either to be located on the side wall within the front or rear half of the house. Near the front or back of the side wall would be preferable when possible.

100. I recently assisted a friend in renovating his basement and was told by an electrician that the electrical circuit panel could not be within a bathroom. Therefore, to comply with the electrical code we constructed a closet within the bathroom so that the panel would not be in the bathroom proper and would not be subject to any humidity. Our local electrical inspector has told us this is unacceptable. It is our understanding that a closet is a separate room within a room with fixed walls and door access as with any room. There is no shower or tub in this area. Would you please help us define the code requirements within this area.

ANS: The panel is in a closet in the bathroom. With the definition of a bathroom "An area including a basin with one or more of the following: a toilet, a tub, or a shower." it is clearly in a bathroom. The code does not allow overcurrent devices in residential bathrooms. Since you need to have the door open to get the proper working clearance it is no different than covering the panel with a cabinet door. It is still in the bathroom. A good example would be previous submittals to CMP's where a closet in the bathroom held laundry machines and GFCI protection was required because the closet is in the bathroom area.

101. The inspector has red-tagged my residential project saying that the insulation in the attic cannot be in contact with the recessed fixtures I've installed. He indicated there must be at least 3 inches of clearance all around and no insulation installed above the fixture. The fixtures are listed and marked "IC" rated. Am I missing something?

ANS: Section 410.116(B) covers installations of recessed fixtures and clearly indicates that if the fixture is marked "Type IC" thermal insulation can be in contact with the fixture. You may have to show the marking on the fixture and the section of the Code that specifically permits thermal insulation to be in contact where so identified.

102. Are equipment grounding conductors EGCs required to be connected together in nonmetallic boxes? Multiple circuits are brought into a nonmetallic box for connection to electronic switches controlling room lights. Each circuit's EGC is connected to its switch's grounding wire. Does the NEC also require that all the EGCs be connected together in the box?

ANS: Yes., Section 250.148(D) requires that all equipment grounding conductors must be connected together within the nonmetallic box and arranged such that a connection can be made to any fitting or device in that box requiring grounding.

103. I have a question pertaining to feeders from a main service disconnect switch to a lighting panel in a single-family dwelling. The voltage is 120/240. If we use #2 AWG 3 conductor aluminum SER cable can the over current protection be 100- Amp?. Does Table 310.15(B)(7) permit 100 amp overcurrent protection for the designated conductors or must the overcurrent protection be reduced to 90-Amperes in accordance with Table 310.16?

ANS: The use of Table 310.15(B)(7) is permitted for 120/240 volt, 3-wire, single-phase dwelling services and feeders where it supplies the entire load. Your description of a lighting panel does not appear to be the entire load as required in order to use Table 310.15 (B)(6).

104. I was wondering if there is a specific way to mount a panel in a residential occupancy? Could they be mounted vertical or horizontal and where is this information in the NEC?

ANS: A panelboard containing circuit breakers must be mounted in a vertical or upright position to allow the circuit breakers to operate in accordance with Section 240.81, which requires that where circuit breakers are operated vertically the up position shall be the "on" position.. If a panelboard is mounted in a horizontal position the bottom row of circuit breakers would be "on" in the down position.

105. Do the laundry outlet(s) need to be GFIC protected, if within 6' of a laundry sink? My typical installation is two single receptacles (one behind each appliance) below where someone could readily access after the installation of a washer and dryer without GFCI protection.

ANS: NEC 210.8(A)(7) requires that receptacles located within 6 feet of the outside edge of the sink in areas other than kitchens be ground-fault circuit-interrupter protected.

106. We are doing a small project at the water utility which required the installation of (3) 3hp exhaust fans. These fans have their own disconnecting means at the unit and are controlled by combination starters. The exhaust fans are located about 20' ft above the finished floor and the city wanted the combination starters located below the exhaust fans but high enough so you would have to use a ladder to reach them. This height was requested so they did not have to worry about someone damaging them. The combination starters are about 7' ft off the finished floor and the city electrical inspector is telling us to lower these starters to 6' 7" to the handle. Is this required by code?

ANS: Yes it is required by code and I would have to agree with the inspector on this issue. Take a look at 404.8(A). It says maximum disconnect height of 6' 7" to the center of the grip or you use 404.8(A) Ex. #2 and install it adjacent to the motor. The way you described it, the disconnect is below rather than adjacent to the motor and it is over 6' 7" above the floor. The way I picture it is, you have a choice of moving it up adjacent to the motor or down to comply with the 6' 7" reach range to comply. Nothing says the combination starters have to be located at that location since you already have a disconnect at the motors. Perhaps you want to move the starters out of that area entirely.

107. I have seen many ceiling-mounted LCD projectors in classrooms, training centers, and conference rooms all over the country. Often the projector is mounted directly to a 2-inch metal sleeve that extends through the ceiling to the structure above. No projector cord is visible as it is routed through the sleeve to a receptacle above the ceiling. Is it Code-compliant to route a cord through the ceiling so as to plug in to the receptacle above the ceiling? Also, is it a Code violation to install a receptacle above a suspended ceiling?

ANS: It is a violation of NEC 400.8(2) and (5) to run a cord through a suspended ceiling and conceal the cord above a suspended ceiling. The Code does not have any exceptions to these requirements. There is no Code provision that would prevent a receptacle from being installed above a suspended ceiling. Article 406 covers receptacle installations, but does not address this specifically. A receptacle could be installed above the suspended ceiling for service work. There are low voltage transformers plugged into a receptacle along with associated wiring that may be installed above a suspended ceiling.

108. My question concerns NEC Section 406.12, Tamper-Resistant Receptacles in Dwelling Units. My argument would be that a detached garage does not fall under the definition of "Dwelling Unit" in Article 100. Therefore, only 210.52 (G)(1) would apply to detached garages. The minimum requirement, as I interpret the NEC, would be (1) receptacle if power is supplied to the garage. And 210.8 (A)(2) or 210.8 (B)(8) would require that receptacle to be GFCI protected. My thought is that the tamper-resistant receptacles would have been mentioned in Article 210 similar to GFCI protection if needed in other areas. At present, only 406.12 Tamper-Resistant Receptacles in Dwelling Units, 406.13 Tamper-Resistant Receptacles in Guest Rooms and 406.14 Tamper Resistant Receptacles in Child Care Facilities are required. Since a detached garage is not included in the definition of a "Dwelling Unit", Article 406.12 would not apply. An attached garage however would be considered in the same structure as a "Dwelling Unit", subject to Section 210.52 and therefore would require tamper-resistant receptacles.

ANS: NEC Section 406.12 requires tamper-resistant receptacles in all areas specified in 210.52. 210.52 (G) Basements, Garages, and Accessory Buildings paren. (1) states: "At least one receptacle outlet, in addition to those for specific equipment, shall be installed in each basement,

in each attached garage, and in each detached garage or accessory building with electric power.” These receptacles whether one or more, are required to be tamper resistant unless they meet the Exception.

109. I installed the grounding electrode conductor for a duplex service by connecting it to the underground metal water pipe where it entered the building and then pulled it through both panels located in the garage and terminated it on the two ground rods in the yard. The inspector said I have two services and would have to install a jumper between the panels. What is this requirement for?

ANS: Section 250.64 (D) provides the rules for services with multiple disconnects as well as options for the connections of the grounding electrode conductor(s). You have 2 service disconnects and are using a common grounding electrode conductor and taps in accordance with (D)(1). If a panel is removed for whatever reason you will lose your grounding electrode conductor connection for the other service. A tap (jumper) on the grounding electrode conductors outside the panels will ensure that the grounding electrode conductor remains intact. The way to look at these is that, if a panel is removed the grounding electrode system must remain intact and functional.

110. Is a supplemental grounding electrode required for a concrete-encased electrode? My inspector says I have to drive a ground rod. The water piping system serving the building is plastic.

ANS: No, the NEC does not require a supplemental electrode for a concrete-encased electrode. This is a requirement for metal underground water pipe electrode(s) as provided in 250.53(D)(2). It states that “A metal underground water pipe shall be supplemented by an additional electrode of a type specified in 250.52(A)2) through (A)(8). Metal underground water pipes may be replaced with plastic and the electrode is gone, hence the requirement to supplement them. A concrete encase electrode will not go away.

111. I received a call last evening with a question in regards to requiring the electrical service be bonded to the metal well casing when the water pump installer installs plastic waterline into a new home. An Inspector is requiring a grounding electrode conductor to be installed to the water well casing in addition to the ground rods for grounding the electric service, or if the electrician installs a concrete encased electrode, then the additional grounding to the well casing is not required. Has anything changed in the NEC that would require this?

ANS: There is no requirement to use the well casing as a grounding electrode. It is permitted but would be treated as a pipe type of electrode in accordance with 250.52 (5). Section 250.112 (M) requires the metal well casing to be connected to the equipment grounding conductor used for the submersible pump.

112. I have an application where I have a switchgear power circuit breaker with an 800 amp frame and 400 amp adjustable trip unit. Per the switchgear manufacturer, the trip unit has a removable cover over it that is screwed down, which we agreed qualifies as ‘restricted access’ under NEC article NEC 240.6 C 1 so the circuit breaker is allowed to have an ampere rating equal to the adjusted long-time current pickup setting of the trip unit. I plan to set the long-time pickup setting for the trip unit at 50% so that the breaker will trip at 200 amps, and in turn size the conductors on the load side of the circuit breaker for 200 amps, not 400 amps. Please confirm that you are in agreement with this. Similarly, I will have other circuit breakers where I will have a 400 amp adjustable trip unit, but will be installing a 300 ampere plug so the circuit breaker will trip at 300 amps. This plug will also be mechanically fastened/covered. Please confirm that the same logic used above would allow me to size the circuit breaker load side conductors for 300 amps and not 400 amps in this application as well.

ANS: Your assertions are correct. Section 240.6 (B) and (C) provide information on adjustable-trip and restricted access adjustable-trip circuit breakers that verify your statements.

113. An individual is installing a 2008 modular home that was previously used as a model home. You have seen them as showplaces along the highway. The local inspector wants electrical changes that reflect recent code changes. Since the home was built and sealed (Wisconsin) in 2008, is the dwelling compliant since it was built more than 3 years ago?

ANS: Yes, it was compliant when it was built and remains compliant. It is like having a product on the shelf. Since the dwelling was built and "sealed" that is the date for code compliance. Any site work would be based on current codes. SPS 316.003 (3) deals with existing installations.

114. I have a bar with a sink in the basement of a new home. The contractor has run 1 circuit to the area. Does this circuit need to be ARC-FAULT and GFCI protected if they are not considering it a kitchen?

ANS: Yes, you have a bar sink and that does not constitute a kitchen although any receptacles within 6 feet of the sink is required to be ground-fault circuit-interrupter protected, they are also required to be arc-fault protected if they are in a room designated in Section 210.(B) of the National Electrical Code (NEC). The list of rooms includes: family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, or similar rooms or areas. The list does not include kitchens or bathrooms. Any other room would probably come under the similar room or area. The circuit would require GFCI and AFCI protection for receptacles within six feet of the sink. An AFCI circuit breaker and GFCI receptacle would meet the requirement. Kitchens are defined as "An area with a sink and permanent facilities for food preparation and cooking." If you had a range or cooktop along with the sink and counter it would be a kitchen and two small appliance branch circuits would be required.

115. Can the flooring inside the electrical working clearance be steel? I have seen rooms where electrical panels are accessed via steel grate platforms. I think the footwear of the person using the equipment is their responsibility. It's maybe part of their PPE.

ANS: Yes, the floor could be steel and in many cases it is steel grating such as on a mezzanine or raised platform. It would be grounded by bonding or however the electrical equipment is fastened to it or even sitting on it. I would not expect a barefoot electrician unless we were in Arkansas or maybe Colorado. Mike or Dick care to comment?

116. I did an annual elevator inspection at the Marinette Marine plant today. The serviceman was with me at the time. We were looking at the main line disconnect switch and you can open the switch with power on. You can turn the power off and lock it out or leave the power on and open the cover. This does not seem proper to me. Any other main line disconnect you must remove the power before opening the switch. You can turn the power back on by moving the locking bar but this one you can open energized or not. Just wondering if you have ever come across this before? It's a Cutler Hammer switch.

ANS: I asked UL and received an answer back. UL 98 does not require the switch to be cold before opening the enclosure. 620.51 of the NEC requires the disconnect and says it "shall be an enclosed externally operable fused motor circuit switch or circuit breaker capable of being locked in the open position." Many switch cabinets will not open until the switch is in the Off position. My question to UL was; Is this a requirement? Their answer, no since the standard UL 98 does not require the switch to be in the off position prior to opening the cabinet. Many new switches have this feature but it is not a requirement. Older switches may not employ the feature but it was not and is not required.

117. I heard that the Code only permits one equipment grounding (bonding) conductor to terminate on a grounding screw terminal. Is this true?

ANS: No, the number of equipment grounding (bonding) conductors permitted to terminate on a grounding terminal is limited in accordance with the equipment manufacturer's instructions

posted on the label located inside the panelboard. Generally two equipment grounding (bonding) conductors can be terminated to a single terminal. Only one grounded (neutral) conductor is permitted on a single terminal in accordance with Section 408.21 of the NEC.

118. What are the disconnecting requirements for a transformer?

ANS: A disconnect is required to disconnect all ungrounded primary conductors of a transformer. The disconnect must be located within sight of the transformer, unless the location of the disconnect is field-marked on the transformer and the disconnect is lockable as noted in Section 450.14. This new Code requirement applies to transformers of any voltage, except Class 2 or Class 3 transformers. *Note:* Within sight means that it's visible and not more than 50 ft from one to the other as defined in Article 100.

119. I work in a very large factory and we have numerous water fountains which are plugged underneath them. This is less than 3' from the fountains and I was wondering if they should be GFCI protected?

ANS: NEC Section 422.52 requires electric drinking fountains to have ground-fault circuit-interrupter protection. This protection can be a part of the fountain, included in the receptacle outlet or provided in the branch circuit. The requirement is not retroactive and I assume the drinking fountains (bubblers) have been there for some time.

120. In the 2008 NEC Section 330.30, (D)(2), it says that the length of MC cables from the last point of connection to the luminaires can be up to 6 ft. Meaning that MC cables can be unsupported for up to 6 ft. However, an inspector told me that in a light fixtures in a suspended ceiling, the MC cable needs to be supported 12 inches from the fitting that connects the light fixtures. Did the rule change?

ANS: NEC Section 330.30(D)(2) requires the last MC cable support to be not more than 6 feet from the point of connection to the luminaire in an accessible ceiling. NEC 330.30(B) requires that Type MC Cable containing four or fewer conductors of size 10 AWG or less be secured within 12 in. of every box, cabinet, fitting, or other termination. The other termination would be a luminaire in a non-accessible ceiling. Section 330.30(D) permits the fittings as a means of support if the installation meets the conditions of this section.

121. I was wondering if there will ever be a ruling on the ground orientation of single and duplex receptacles? Some project specifications require a 'Ground Up' orientation while other installations are building owner preference. Will we see a definitive answer in a future NEC?

ANS: We already have a "ruling" (probably a dozen times). It's not a safety issue. Substantiation has not been provided to show a hazard to persons and property involving the orientation of receptacles. It is a design consideration beyond the intent of the Code. Personally I like the ground up because that is the way I was taught to install them.

122. Does the concrete encased grounding electrode conductor have to connect directly to the main service or can it be connected to a cold water line?

ANS: The concrete-encased electrode, sometimes called the Ufer ground named for the man who devised this type of electrode, if present, is a part of the grounding electrode system and must be bonded together with any other grounding electrodes shown in 250.52. The grounding electrode conductor is permitted to be run to any convenient grounding electrode available in accordance with Section 250.64(F)(1) or it could be run to the main service. Bonding jumpers are often used to connect the grounding electrodes together to form a grounding electrode system as addressed in 250.53(C). Section 250.53(C) indicates that the bonding jumper(s) used to connect the grounding electrodes together to form the grounding electrode system must be installed to comply with Section 250.64(A), (B), and (E), and be sized in accordance with 250.66, and they must be connected according to Section 250.70.

123. Is it acceptable to install communication cable in the same lighting pole that is being used as a raceway for lighting conductors?
ANS: Only if there is a barrier or listed divider between the communication cable and the power conductors. Communications conductors must not be placed in any raceway, compartment, outlet box, junction box, or similar fitting with conductors of electric light, power, or Class 1 circuits in accordance with Section 800.133(A)(1)(d). Exception No. 1 allows communications circuits within the same enclosure with conductors of electric light, power, and Class 1 circuits, where separated by a permanent barrier or listed divider. Separation is required to prevent a fire or shock hazard that can occur from a short between the communications circuits and the higher-voltage circuits.
124. Are outlet boxes allowed to be supported by the ceiling framing members of a suspended ceiling system or must independent support wires be added?
ANS: Outlet boxes *can* be supported by the structural or supporting elements of a suspended ceiling, if securely fastened by one of the following methods in accordance with Section 314.23(D). *Ceiling-framing members*. An outlet box can be secured to suspended-ceiling framing members by bolts, screws, rivets, clips, or other means identified for the suspended-ceiling framing member(s). If framing members of suspended-ceiling systems are used to support luminaires, they must be securely fastened to each other and must be securely attached to the building structure at appropriate intervals. In addition, luminaires must be attached to the suspended-ceiling framing members with screws, bolts, rivets, or clips listed and identified for such use [410.36(B)]. *Independent support wires*. Outlet boxes can be secured, with fittings identified for the purpose, to the ceiling-support wires.
125. Does the NEC require that replacement receptacles be updated to provide GFCI protection?
ANS: When existing receptacles are replaced in locations where GFCI protection is currently required, the replacement receptacles must be GFCI protected. This includes the replacement of receptacles in dwelling unit bathrooms, garages, outdoors, crawl spaces, unfinished basements, kitchen countertops, rooftops, or within 6 ft of laundry, utility, and wet bar sinks. Section 406.4(D)(3) of the NEC provides the requirements. See Section 210.8 for specific GFCI-protection requirements.
126. Is there a compliance issue that does not allow multiple extension cords to be placed in series to make a longer extension, on a temporary basis?
ANS: NEC 590.2(B) requires that temporary wiring methods be approved based on the conditions of use and any special requirements of the temporary installation. Fire prevention codes do not allow daisy chaining of extension cords.
127. Is a box required where nonmetallic sheathed cable is installed through a hole in an outside wall for a lighting fixture? I have seen installations where a fixture strap is mounted on the wall and the NM cable terminates in the fixture canopy with limited space.
ANS: The answer is yes a box is required in accordance with Section 300.15 of the NEC. It says a box or conduit body shall be installed at each conductor splice point, outlet point, switch point, junction point, termination points or pull point. This is the general rule and there are exceptions that permit other than a box. None of the exceptions permit a fixture strap secured to a wall.
128. I am bidding on some cottages (this is what the owner calls them). They are about 10' x 20'. Inside there is only 2 bunk beds, a refrigerator, and a window air-conditioner. They are portable and designed to be moveable if needed. Each is supplied by a 20 amp 120v circuit. Do the interior circuits need to be AFCI protected?
ANS: No, NEC Section 210.12 (B) says "All 120-volt, single phase, 15- and 20-ampere branch circuits supplying outlets installed in dwelling unit family rooms, dining rooms, living rooms,

parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways or similar rooms or areas shall be protected by a listed arc-fault circuit interrupter, combination-type, installed to provide protection of the branch circuit." That being said; we can look at the definition of a dwelling unit in accordance with the NEC. "Dwelling unit, A single unit, providing complete and independent living facilities for one or more persons, including permanent provisions for living, sleeping, cooking and sanitation." Based on the 2008 NEC and the description provided of the "cottage" AFCI protection is not required. The description is closer to a guest room in a motel rather than a dwelling.

129. We have a new house being built in town where the owner does not want any receptacles showing in the bathroom. The general contractor is asking if a receptacle inside the vanity will satisfy the requirement for a bathroom receptacle. The owner does not want a receptacle showing on the wall or on the side of the vanity, she wants it inside of the vanity. I don't know if that will satisfy the code requirement or does the receptacle have to be visible?

ANS: When we look at 210.52 (D) it says within 3 ft of the sink on the wall or partition, or installed on the side or face of the basin cabinet not more than 12 inches below the countertop. This would not prohibit a receptacle from being inside the cabinet as long as it is mounted on a side or face and within 12 inches of the countertop. I could envision it located below the sink, on the side behind the cabinet door and being in compliance. It needs to be high enough to be within 12 inches of the countertop.

130. I came across existing light poles with concrete bases installed with a ground rod in each base. An equipment grounding conductor was connected from the light pole to the ground rod. No equipment grounding conductor is pulled with the phase conductors supplying these light poles. The conduit supplying the light poles is plastic. I believe this creates a parallel path to ground that might allow undesirable ground current without tripping the breaker feeding the lights. The wire in the existing conduit feeding the light poles cannot be moved so it seems impossible to add an equipment grounding conductor to the branch circuit feeding the light poles, without replacing all the conduit and wire. I feel it is necessary to install a GFCI breaker to provide protection for personnel working on or near the light poles. I have not been able to find in the code any reference to allow this, other than for replacing ungrounded dwelling unit receptacles with grounding type. Is this a workable solution? The breaker should trip if there is any objectionable current to ground therefore providing protection of personnel. Could this be considered an example of a "legal non-conforming installation"? Some of the existing poles are severely deteriorated, as well as the concrete bases. 2 poles have fallen down due to wind and corrosion. We are removing some of the existing bases and installing new ones – which is where the problem comes in. The feed for the new bases comes from some old bases to remain, that do not include an equipment ground. An equipment ground is to be installed in all new wiring extended from the old base, but it would not be continuous to the existing service, hence the problem. The existing service is a few hundred feet away – under pavement. Are you aware of any other acceptable method to extend the existing wiring? Essentially we are replacing existing, worn out equipment with new equipment. The code requires these new bases be served with a branch circuit that includes an equipment grounding conductor, and the extension of the existing circuit is not allowed.

ANS: I went back to the May 1, 1972 effective ILHR 16 which had in E1.02 Scope (2) Not Covered (e) Installations under the exclusive control of electric utilities or municipal electric departments for the purpose of street or area lighting. The current SPS 316.002 (2) (e) states: Installations for the purpose of street or area lighting owned and under exclusive control of electrical utilities or municipal electric departments where located outdoors on property owned or leased by the utility; on or along public highways, streets, roads or similar public thoroughfares; or outdoors on private property by established rights such as easements, where such installations are in compliance with ch. PSC 114. PSC 114 uses the National Electrical Safety Code (NESC) to regulate utility electrical installations in Wisconsin. I would guess these lights were installed

accordingly and the rod at each pole is for lightning protection. While placing GFCI protection on the lighting circuit would certainly provide an installation that is safer than the current configuration, there is no provision in the NEC to do so in place of an equipment grounding conductor. You are correct in that the NEC allows replacing receptacles without an equipment ground with one providing GFCI protection. This applies to all receptacles not just dwellings. There is no provision to use a GFCI in place of an equipment grounding conductor on other than receptacles. With your guess of installation in the 70's I went to the 1971 NEC. NEC Article 250 Part E covers Equipment Grounding. 250.42 Fixed Equipment says: "Exposed noncurrent-carrying metal parts of fixed equipment that are likely to become energized under abnormal conditions shall be grounded under any of the following conditions. (a) Where within 8 feet vertically or 5 feet horizontally of ground or grounded metal objects. (b) Where located in a wet or damp location and not isolated.

(c) Where in electrical contact with metal.

(d) Where in a hazardous location as covered by Articles 500 through 517.

(e) Where supplied by a metal-clad, metal-sheathed, or metal-raceway wiring method.

(f) Where equipment operates with any terminal in excess of 150 volts to ground.

Section 250.43 of the 1971 edition lists specific equipment but does not include lighting fixtures. In checking the 1975 NEC I found it has identical language and no changes. The 1978 NEC removed the words "under ABNORMAL conditions" from Section 250.42 and rewrote 250.43 to include "(j) Lighting fixtures as provided in Part E of Article 410" as equipment requiring grounding. When you go to Part E of Article 410, Section 410-18 Exposed Fixture Parts says "(a) The exposed conductive parts of lighting fixtures and equipment directly wired or attached to outlets supplied by a wiring method which provides an equipment ground shall be grounded. (b) Fixtures directly wired or attached to outlets supplied by a wiring method which does not provide a ready means for grounding shall be made of insulating material and have no exposed conductive parts." Based on the language I would seem that when the state adopted the 1978 NEC (Effective January 1, 1979) equipment grounding would have been required for lighting fixtures with any exposed metal components. Prior to that date it could have been a two-wire circuit where the fixtures were over 8 feet in height and the wiring method did not include a metal sheath, cable or raceway, and in general met the installation requirements of 250.42 of the NEC. This being said, I would recommend the installation of an equipment grounding conductor on the circuits but cannot require it. If you choose to install an equipment grounding conductor the requirements of Section 250.130 (C) in the 2008 Edition of the NEC would specify the requirements for circuit extension of a branch circuit without an equipment grounding conductor. The branch circuit extension equipment grounding conductor may be connected to any of items 1-4 in the list provided. These include an accessible point on the grounding electrode or grounding electrode conductor as well as the ground bar where the branch circuit originates and/or the grounded service conductor within the service equipment enclosure. I believe that you are correct in that the installation was acceptable at the time of installation. It may be time for replacement!