NUCCORP

Nuclear Grade Air Trap - NGAT™

Frequently Asked Questions
(FAQ)

1. What is the NGAT™?

   The NGAT™ is a special venting system that provides a total solution for quantifying and venting unwanted gas from safety-related fluid systems. First, the NGAT traps unwanted gas from otherwise liquid-filled, safety-related fluid systems. Then, the NGAT provides continuous indication, either remotely or locally, of the volume of gas collected and alerts operators when system venting is required. Finally, the NGAT allows operators a means to vent the unwanted gas, which assures compliance with US Nuclear Regulatory Commission (NRC) Generic Letter 2008-01 (GL08-01).

2. What makes the NGAT™ superior to other void detection methods?

   The NGAT™ utilizes basic, passive laws of nature, such as buoyancy and magnetism, to ensure the most reliable indication of trapped air/gas at local high points in ECCS and other safety-related fluid systems. NGAT™ provides a direct indication of the accumulated air/gases in fluid systems, without the need for specially qualified personnel to interpret results, as is the case with ultrasonic measurements (UT). Additionally, many local high points in stations' systems have no installed vents; so if air/gas is found with UT, there is no way to remove it. The NGAT™ serves as both an air/gas indicator and vent.

   When positioned correctly along the piping system the NGAT™ indicates the accumulation of air/gas <u>prior</u> to it reaching the main piping where the presence of non-condensables is highly undesirable and could result in damage to safety-related pumps.

   The NGAT™ provides literal compliance to GL08-01 by indicating on the visible gauge that fluid systems are "full" at the installed locations.

3. What is the NGAT™ Gas Management Program™?

   The NGAT™ Gas Management Program™ is an integrated approach and solution to the issues surrounding NRC GL08-01 and INPO SER 2-05, Rev 1. NUCCORP can help station personnel develop robust gas management programs to ensure compliance with GL08-01 and implement a solid program to enables the station to prepare for and pass upcoming NRC audits and inspections. NUCCORP will help provide self-assessments of existing gas management programs by utilizing the latest NRC Inspection Manuals to further prepare the station for NRC audits (e.g., NRC Temporary Instruction 2515/177, ADAMS file-number ML0829506661).

4. Can the NGAT™ provide both local and remote indication/alarm of air accumulation?

   Yes. The NGAT™ has options for local indication, remote indication and alarm or both upon the stations' needs.

5. The water in our Containment Spray, RHR and ECCS systems contain up to 2500 ppm of Boron via a Boric Acid solution. Is there any way for the Boron to plate-out inside of the NGAT™ chamber and cause the float to stick to the interior walls of the chamber, which could cause false level indication?

No. In order for Boron to crystallize, a significant increase in Boron concentration would have to be present. In the unlikely event that this concentration is present the Boron will be flushed from the chamber during each outage as the systems are refilled and vented using the NGAT. In the absolute worst case scenario, if a crystal coating is formed in the gap between the float and the body of the NGAT, it could not form enough to impede the buoyancy action of the float.

6. Is it likely that foreign material could lodge between the float and the NGAT™ chamber wall such that a false indication of level would be produced?

   No. With the high standards of FME controls set in place throughout the commercial nuclear industry, it is highly unlikely that this would occur. If it were to occur, it would be during initial system fill and vent coming out of an outage. If this was of concern, a manually-operated magnetic tester can be used on the outside of the chamber to pull the float down into the water. When the tester magnetic field is removed, the float will "bounce" in the water, which can be observed on the indicator. This would provide a high level of confidence that no debris is impeding the buoyancy of the float. Once the initial fill-and-vent of the system is finished, the majority of ECCS systems are static during the fuel cycle, so no debris intrusion mechanism exists after the initial fill and vent are accomplished, since the NGAT™ is mounted vertically to the top of the existing piping.

7. The magnets inside of the NGAT™ float are made from ALNICO which contains ^{59}Co. Is there any chance that the production of ^{60}Co could become a problem?

   No. First, no mechanism exists for the transmutation of ^{59}Co to ^{60}Co. ALNICO is an alloy of Al, Ni and Co. ALNICO is used to create strong, permanent magnets. These magnets are internal to the NGAT™ Titanium float. The naturally occurring, non-radioactive ^{59}Co in ALNICO would have to be exposed to a high neutron flux in order to transmute into the radioactive isotope ^{60}Co. Most ECCS locations, where the NGAT is a candidate, are outside of the containment structure and certainly outside of the bio-shield walls where the neutron flux is exceeding low or non-existent.

   Second, each location that has been identified for an NGAT installation will be evaluated by NUCCORP engineers to ensure that ^{60}Co is not an issue.

   Finally, if use of Co is simply not desired or acceptable, rare-earth magnets, produced from neodymium, can be substituted.

8. The floats are made from Titanium. How do we know that the floats are structurally robust enough to ensure integrity is maintained following a postulated design-basis seismic event?

   The walls of the float are relatively thin to ensure a proper weight-to-buoyancy ratio; the floats are seismically qualified by calculation for 10g acceleration, which should bound any station's seismic criterion. Each float is hydrostatically tested. The floats are provided as an "augmented quality" component.

9. What would be the consequences of a float being damaged to the extent that the wall of the float is breached?

   This failure mode is conservative and in the very unlikely event that a hole or through-wall crack developed in the NGAT™ float, two things would happen:

   i. The float would fill with water and sink to its low level, which is defined by the position of the lower retaining orifice. This conservatively would alert the Operator that air/gas had rapidly accumulated in the chamber or that the float wall was indeed breached. The required Operator actions would be defined in the station's procedures. The following actions would be suggested:

1. The vent-valve could be opened and the chamber filled with water from the fluid system to verify that the float had indeed sunk.
2. An alternate, yet less desirable indication method, such as UT, could be temporarily employed to track any air/gas accumulation, until such time that the float could be replaced.

ii. Air inside of the float would enter the chamber and water would fill the float. The standard float in the NGAT™ is not pressurized; it is seal-welded during the manufacturing process such that unpressurized air exists internal to the float. Furthermore, as the float is heated during the welding process, any heated air expands out of the float. Once the float is sealed, there is actually less air mass than would be calculated in the internal float volume if it were sealed with air at atmospheric conditions. The maximum free volume inside of the float is 250cc (8.8×10^{-3} ft^3), an insignificant volume. While a float-wall rupture could be postulated, it is highly unlikely. All individual floats are hydrostatically tested to 650 psig at 400F.

10. The floats are designed for most applications and will withstand an external pressure of 650 psig at 400F. What if there is a NGAT™ application where the design pressure of the system needs to be at a greater pressure?

    NUCCORP engineers can design custom floats to allow an increase in the external design pressure of the float. NUCCORP will work with the station's engineers to find the best solution for the situation at hand.

11. NRC GL08-01 mentions a concern regarding the uncertainty of quantifying accumulated air/gas that may have built up at local high points. How do the capabilities of the NGAT™ meet these requirements?

    The NGAT™ is extremely accurate and can easily indicate the air/gas level to within +/- 1 inch. This is equivalent to the accumulated air-volume-accuracy of +/- 10cc and +/- 3.4×10^{-4} ft^3.

12. How can the NGAT assist our utility in a location that is known to have an unusually high volume of gas voids?

    While in most situations the NGAT's "one size fits most" design be will appropriate, occasionally a CCW or other system experiences larger volumes of gas intrusion. For these cases NUCCORP has designed a larger, wall-mounted NGAT with an ASME N-Stamped tank that has a volume of several cubic feet.

13. How do we know if our systems are "full" to ensure we remain OPERABLE in accordance with our Technical Specifications?

    For each installation location, NUCCORP can provide a calculated minimum allowed level such that absolutely no initially trapped air would be re-introduced into the ECCS (or other safety-related systems) in the postulated post-LOCA sequence of events. Also, the volume of air that would be expected to re-enter the systems following a LOCA will be provided, assuming that the water-air interface level in the float was at the minimum value. For most plant locations, it can be shown that the amount of air that could be re-introduced is much less than allowed at the particular local high point, in which case, as long as the NGAT™ indicates some level, and then OPERABILITY is assured. Either way, NUCCORP will cover all possibilities by calculation and provide the pertinent results to the station for each NGAT™.

14. How is a NGAT™ installed?

    The process of NGAT™ installation is simple.

    a. The station produces a vent hole at the top-dead-center of the identified local high point in the subject system.

b. A 2” NPS fitting is then centered and welded onto the main piping. This fitting is typically a socket-welded fitting, better known as an S-O-L; the fitting could also be a butt-welded type fitting, known as a weld-o-let (W-O-L).
c. Then the end of the NGAT™ is welded to the new pipe fitting.
d. After that, the float is inserted into the NGAT™ chamber.
e. The gaskets and lower retaining device are placed between the two flanges and the bolted-joint is made up in accordance with station procedures.
f. At this point the NGAT™ tail-piping (if needed) can be routed and the vent valve installed per the station’s design modification package.

15. Can NUCCORP provide assistance in the development of our design change package?

    Yes. NUCCORP engineers have over 25 years of experience in the commercial nuclear power industry and can consult with the station’s responsible design engineers over various aspects of the design package. We can also aid in developing the 10CFR50.59, which is generally included in the station’s modification packages.

16. How would the installation of the NGAT™ impact our station pipe stress analyses?

    Modal analysis of the standard NGAT™ models shows that the lowest natural frequency exceeds 33Hz; therefore, the inherent stiffness of the NGAT™ allows the pipe analyst to conveniently model the NGAT™ as a lumped mass. If tail-piping is to be installed, the station’s pipe analyst would ensure that the end-loading conditions are within specified design limits.

17. What is the recommended vent-hole size that we would need to make in our existing piping for the NGAT™ installation?

    The recommended vent-hole size is a minimum ¾” hole in the station’s existing piping. The hole can be as large as the inside diameter of the 2” pipe-fitting if the station desires. Any choice of hole-size in the range of ¾” to 2” has no effect on the performance or operation of the NGAT™. For retrofit of existing vents, ½” would be the absolute minimum allowed.

18. We already have many simple vents in our station and recently installed new vents to comply with our GL08-01 commitments. Can we retrofit the existing vents to take advantage of the NGAT™?

    Yes. It is very simple to retrofit an existing vent. The process would involve cutting the existing vent pipe near the top of its pipe fitting (e.g., just above the half-coupling). Then, a 2” socket welding fitting (S-O-L) would be centered over the remaining vent stub and welded onto the piping. The lower end of the NGAT™ would then be welded into the fitting. Also, the existing vent valve could be re-used. If desired by the station, NUCCORP can assist with the retrofit process.

19. We have limited head-room at the location where an NGAT™ is desired. Are there any options in this situation where we could install and take advantage of the NGAT™?

    Yes. It is always possible to core-drill through ceilings and run smaller piping up to a higher station elevation where the NGAT™ could be located. Also, if the room in question has some sections with higher ceilings, vent piping could be run and sloped-up to a remote, wall-mounted NGAT™.

20. We have locations where an NGAT™ is desired, but the vent valve will not be easily accessible. Are there options for routing the vent valves to lower elevations for operator convenience and therefore eliminating the need for unsafe scaffolding and ALARA situations?

Yes. This is where the NGAT™ shines. The vent valve associated with the NGAT™ can be routed to an elevation that is lower than the main piping being vented. NUCCORP will calculate the minimum required water-solid flow-rate during venting to ensure that the vertical portions of the tail-piping remain full. This ensures a minimum mass of air is trapped in the NGAT™, which makes certain no air/gas is reintroduced into the main piping during post-LOCA conditions.

21. How do we measure the water-solid flow during venting to ensure that the minimum flow-rate required is obtained and the vertical portions of the tail-piping remain full?

    If there are no contamination concerns, the water-solid flow-rate can be verified with a bucket and stopwatch. However, most stations will desire to route the flow to the liquid rad-waste system in a near-by drain to minimize personnel contamination events. In this case, NUCCORP can provide a hand-held "vent rig" to aid in this process. The vent rig consists of Swagelok SST flexible hoses, a Swagelok needle valve and a compact mechanical flow-meter. This rig will minimize duty on the installed vent valve, allow for a more controlled venting process, allow for quantification of the flow-rate and allow the flow to be directed to the appropriate station drain. NUCCORP can design and provide custom vent-rigs to meet your needs.

22. We have identified locations in our Auxiliary Feedwater System (AFW) where air accumulation is likely, but our AFW piping is carbon steel (CS). Will the CS interfere with the float magnets?

    No. The NGAT™ has a float retaining device located between the air/gas chamber and the flanges to prevent the float from getting to close to the CS, thus ensuring no magnetic interference will occur between the float and the CS pipe or fittings. A bi-metallic weld may be required to connect the lower portion of the NGAT™ to the main AFW piping.

23. What keeps the float from entering the main ECCS piping if large amounts of air accumulate at the installed location?

    The NGAT™ employs a specially designed float retaining device located between the air/gas chamber and the flanges. This retaining device defines the low-end indication range and makes it physically impossible for the float to drop any lower.

24. Will the NGAT™ also function as a vent to allow air back into the piping during system drain-downs for maintenance?

    Yes. The NGAT™ is purposely designed to allow flow of air and/or water in either direction.

25. How often must the float be replaced and how much headroom is required to replace float?

    For those NGAT™ locations that are never exposed to high fluid temperatures, like the containment spray system, it is recommended, but not absolutely necessary, to replace the float every 10 years. For those exposed to relatively hot water, like in the normal RHR system cooldown loops, it is recommended, but not absolutely necessary, to replace the float every 6 years. These recommended PM frequencies can be adjusted by the station, as required. Only a couple of inches of vertical clearance are needed to replace a float.

26. Are there any special storage requirements for the magnetic floats?

    No. Spare floats can be stored next to each other and on carbon steel shelving, with no loss or weakening of the magnetic field.

27. Does the NGAT™ level indication require periodic calibration?

The indicator that is firmly affixed to the chamber after it is positioned in accordance with instructions from NUCCORP. It is recommended that this position, which is easily field-verified via a gap measurement, remains within the tolerance provided. NUCCORP recommends checking of this gap every refueling outage. This ensures confidence is maintained in regard to any defined minimum allowed levels.

28. If the NGAT™ is installed downstream of pumps, is there a problem with pump start-up pressure surges?

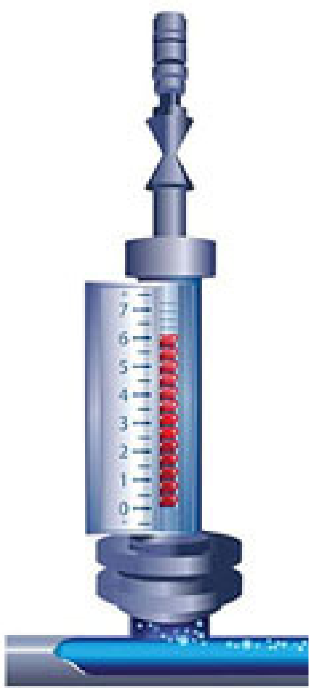
    No. In fact, the NGAT™ will act as a surge suppression device when there is air in the chamber. If the NGAT™ is full of water (i.e., no trapped air), it is no more susceptible to surges as any other component in the piping system. Since the NGAT™ is designed to the same, if not higher, pressure conditions of nearby components, pump start-up surges are of no concern.

29. What does the NGAT™ Program include?

    NUCCORP's job is to bring a plant into full, permanent compliance with NRC GL-2008-01 by ensuring that the utility has a safe, simple, and robust Gas Management program in place. NUCCORP can aid in the re-design of existing vent systems and licensing of such systems as our customers require.

    Using our experience from successful installs and program development, NUCCORP can assist in development and writing of procedures, manuals and the training of Gas Management personnel.

    Additionally, we are available for consulting and pre-audit of Gas Management Programs in advance of a formal NRC audit.



NGAT Symbols

NUCCORP - Providing Innovative Solutions to the Nuclear Power Industry