

NUCCORP

Providing Innovative Solutions to the Nuclear Power Industry

Technology White Paper

Nuclear Grade Air Trap™ (NGAT™)

US Patent 8505568. Other Patents Issued Worldwide. All Rights Reserved.

Executive Summary

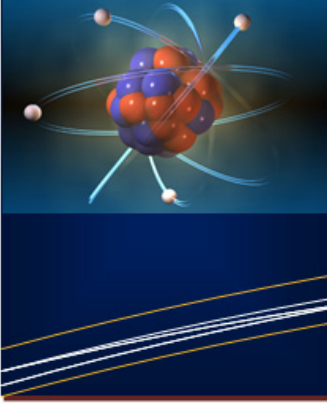
The commercial nuclear power industry experiences constant challenges and emerging issues from a variety of sources, most of which are formalized by the US Nuclear Regulatory Commission (NRC). One of the recent issues identified by the NRC regards problems associated with entrapped air/gases in otherwise liquid-filled safety-related fluid systems. These concerns and mandatory licensee actions are outlined in NRC Generic Letter 2008-01 (GL 08-01). The final form of these required actions became US law with the publishing of Technical Specification Task Force 523 Rev 2 in the US Federal Register on January 15, 2014.

Many industry events have been documented which attribute unwanted air/gases damaging safety related pumps. However, a new technology has been developed to allow licensees to track, control the accumulation of, and eliminate unwanted air/gases before potential damages can occur. The solution to these problems is obtained by implementation of the Nuclear Grade Air Trap™ (NGAT™).

Overview

Because of GL08-01 requirements, most commercial nuclear power stations are currently required to identify all high-points in various Emergency Core Cooling Systems (ECCS) and to take monthly actions to perform ultra-sonic inspections (UT) to ensure no air/gas is accumulating. This is a labor and radiation-dose intensive activity, which also requires non-permanent structures (scaffolding) to remain erected in safety-related areas of the station, which creates undesirable plant configurations. Furthermore, stations are finding that many local high points which exist in the ECCS are not fitted with vent valves; so once air/gas is found, there is no way to remove it, which could lead to costly plant shutdowns. This is where the NGAT™ provides a total solution.

The NGAT™ traps unwanted air/gas. It monitors and allows operators to vent-off the unwanted air/gas. The NGAT™ component itself consists of a 2" SST vertical chamber into which a specially designed Titanium, magnetic float is installed (see diagram on next page). As air/gas accumulates in the chamber, the float will drop with the water level, which is indicated on an externally mounted magnetic indicator and/or level-indicating switches for both local and remote monitoring. The NGAT™ will indicate and show the operator when the minimum allowed water level is reached, at which point the operator will vent off the air/gas, which will refill the NGAT™ completely with water. Once this occurs, the NGAT™ passively goes back to the task of providing a constant indication of the accumulation of unwanted air/gas. The NGAT™ greatly enhances nuclear safety by keeping the air/gas out of the main ECCS piping,



NUCCORP

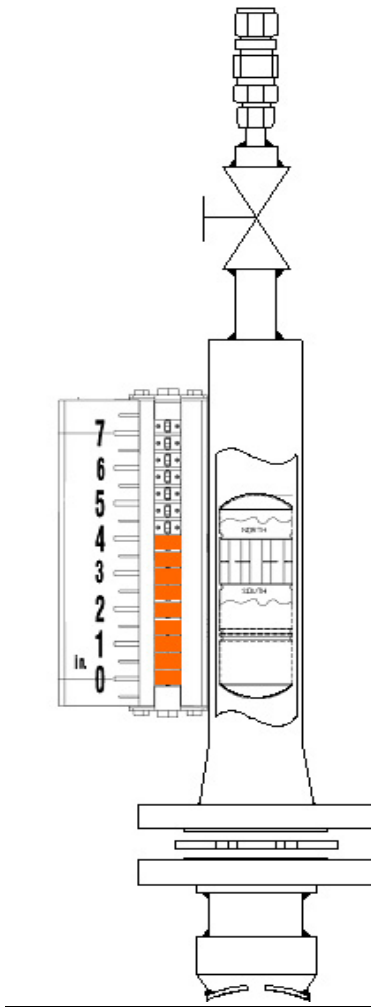
Providing Innovative Solutions to the Nuclear Power Industry

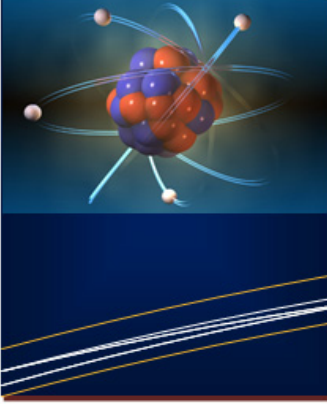
Technology White Paper

Nuclear Grade Air Trap™ (NGAT™)

US Patent 8505568. Other Patents Issued Worldwide. All Rights Reserved.

where serious damage could occur, if the air/gas was left in place. The NGAT™ provides a great advantage over UT, as the accumulation of air/gas is constantly indicated, remotely and/or locally, which eliminates the need for sending UT crews into high radiation areas and eliminates the unsafe practice of maintaining scaffolding over and around other safety-related equipment. The NGAT™ is available as a Safety Related component up to a grade of ASME Section III, Class 2. Standard ASME B16.5 Classes are available in 150lb, 300lb, 600lb, and even up to 1500lb. The NGAT™ pressure-retaining air-chamber is formed and precision-machined from solid forgings of SA182, F316, with no welds (other materials are available) under NUCCORP's audited Appendix B Quality Program.





NUCCORP

Providing Innovative Solutions to the Nuclear Power Industry

Technology White Paper

Nuclear Grade Air Trap™ (NGAT™)

US Patent 8505568. Other Patents Issued Worldwide. All Rights Reserved.

Simplified 150lb Class NGAT™ and Photo of Actual Installation

Existing Installations

Three US nuclear stations are currently benefitting from the advantages having implemented the NGAT™ with twenty (20) NGAT's™ installed (and more installations planned). The NGAT's™ have already provided indication of trapped air on various separate occasions, and have been promptly vented to maintain the station's ECCS fully OPERABLE per station Technical Specifications, which ensures the highest level of nuclear safety.

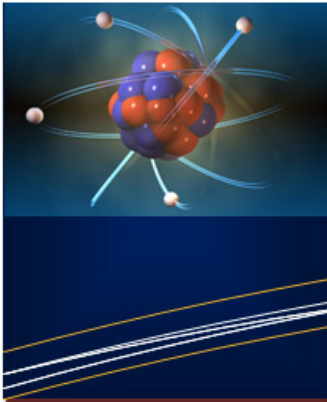
NGAT™ installations have been review by INPO and WANO observers and in all cases have been noted as a strength and an asset.

Conclusion

The advent and application of the NGAT™ is making a tremendous impact in the commercial nuclear power industry by greatly enhancing nuclear safety, industrial safety and helping maintain worker radiation doses As-Low-As-Reasonably-Achievable. The proper application of the NGAT™ resolves concerns outlined NEI 09-10, Rev 1 and in NRC GL08-01 by trapping and removing the unwanted air/gases before the problem worsens. Unwanted air/gases are kept out of the main ECCS piping, thus meeting the intent of GL 08-01, and the NGAT™ provides uninterrupted indication of ECCS and other safety-related system's OPERABILITY.

Nuccorp's engineers, Framatome (NUCCORP's exclusive stock distributor) and NuSource (NUCCORP's custom applications fabricator) work with utility engineers and technicians to provide turn-key solutions to Air/Gas Management issues. Services include engineering review, recommendations, system design, NGAT™ manufacturing, installation supervision, training, procedure development, technician/ program certification and follow-up consulting.

The NGAT™ will ensure a lock-step solution and constant, literal compliance with licensing requirements regarding air/gas management issues



NUCCORP

Providing Innovative Solutions to the Nuclear Power Industry

Technology White Paper
Nuclear Grade Air Trap™ (NGAT™)

US Patent 8505568. Other Patents Issued Worldwide. All Rights Reserved.

References

1. NRC Information Notice 88-23, "Potential for Gas Binding of High-Pressure Safety Injection Pumps During a Loss-of-Coolant Accident"
2. NRC Information Notice 88-74, "Potentially Inadequate Performance of ECCS in PWRs during Recirculation Operation Following a LOCA"
3. NRC Information Notice 94-36, "Undetected Accumulation of Gas in Reactor System"
4. NRC Information Notice 96-65, "Undetected Accumulation of Gas in Reactor Coolant System and Inaccurate Reactor Water Level Indication During Shutdown"
5. NRC Information Notice 06-21, "Operating Experience Regarding Entrainment of Air Into Emergency Core Cooling and Containment Spray Systems"
6. NRC GL 2008-01, "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems"
7. NRC Information Notice 2011-17: "Calculation Methodologies for Operability Determinations of Gas Voids in Nuclear Power Plant Piping", July 26, 2011 (ADAMS: ML11161A111)
8. TSTF-13-02 Rev 2 of TSTF-523, "Generic Letter 2008-01, Managing Gas Accumulation."
9. "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems," NRC Generic Letter 2008-01, January 11, 2008. (ADAMS Accession No. ML072910759)
10. Slough, Robert, "TSTF-523 Revision 2, "Generic Letter 2008-01, Managing Gas Accumulation" Letter to NRC, February 21, 2013. (ADAMS Accession No. ML13053A075)
11. NEI, "Guidelines for Effective Prevention and Management of System Gas Accumulation," NEI 09-10 [Rev 1a-A], April, 2013. (ADAMS Accession No. ML13136A129)
12. Jackson, Christopher P., "Gas Management Action Plan Update", NRC Memorandum to Timothy J. McGinty, February 24, 2014 (ADAMS Accession No. ML14052A170)
13. Hay, Michael, "NRC Integrated Inspection Report Number 05000285/2014002 And Notices Of Violations", NRC Letter to Lou Cortopassi, Omaha Public Power District, Fort Calhoun, March 19, 2014 (ADAMS Accession No. ML14078A666)
14. Miller, Geoffrey B., "NRC Problem Identification And Resolution Inspection Report 50-528/2014007, 50-529/2014007, And 50-530/2014007 ", NRC Letter to Randall K. Edington, Arizona Public Service Company, A Palo Verde, May 14, 2014, Page 11 (ADAMS Accession No. ML14134A307)
15. Simpson, Patrick R. "Application to Revise Technical Specifications to Adopt TSTF-523, Generic Letter 2008-01, Managing Gas Accumulation," Revision 2, Using the Consolidated Line Item Improvement Process", Exelon Letter to NRC, July 14, 2014, Page 66 (ADAMS Accession No. ML14195A172)
16. "Nuclear Grade Air Trap" and NGAT are trademarks of NUCCORP, Inc., USA. US Patent 8 505 568. Other US and WIPO patents pending. All Rights Reserved.