WSRC-TR-2001-00493, Revision 0

RATE OF NO_X EVOLUTION FROM SODIUM NITRITE/ANTIFOAM SOLUTIONS (U)

M. E. Stone

Westinghouse Savannah River Company
Savannah River Site
Aiken, SC 29808

SAFETY • RESPONSIBILITY • SECURITY
SRS
SAVANNAH RIVER SITE

PREPARED FOR THE U.S. DEPARTMENT OF ENERGY UNDER CONTRACT NO. DE-AC09-96SR18500

This document was prepared in conjunction with work accomplished under Contract No. DE-AC09-96SR18500 with the U.S. Department of Energy.

DISCLAIMER

WSRC-TR-2001-00493, Revision 0

Keywords: DWPF, NOx, IIT 747, Offgas

Retention: Permanent

RATE OF NO_X EVOLUTION FROM SODIUM NITRITE/ANTIFOAM SOLUTIONS (U)

M. E. Stone

Publication Date: October 9, 2001

TABLE OF CONTENTS

INTRODUCTION

The Defense Waste Processing Facility (DWPF) utilizes 40% sodium nitrite solution and two 5% antifoam solutions, Dow Corning 544 or Illinois Institute of Technology (IIT) 747. These solutions are stored under ambient conditions within a common containment system inside the facility. The maximum volume of each chemical in DWPF is 615 gallons of sodium nitrite and 180 gallons of antifoam. The amount of NO_x released if the antifoam and sodium nitrite were mixed was measured to determine if the TEEL-1 limit of 2 ppm would be exceeded in a 49,000 ft^3 volume.

TASK OBJECTIVE

The objective of the testing was to determine the release rate of NO_x from mixtures of sodium nitrite and antifoam solutions.

TEST METHODS

The tests were conducted with 1 liter of sodium nitrite and 293 ml of antifoam solution (1/2328 scale). The solution was continuously stirred during the experiment to ensure that all gases were removed from the solution as they were generated and that the antifoam and sodium nitrite solutions were in intimate contact. A water jacket was utilized to maintain the desired temperature during the experiment. The NO and NO_2 generated was measured by an Enerac 2000E gas analyzer. Calculations were then performed to determine the release rate from a mixture of the full-scale volumes and the resulting NO_x concentration in a 49,000 cubic feet volume. The experimental apparatus is shown in Appendix A.

RESULTS

Baseline tests were conducted with each antifoam at 25 °C and no emissions of NO_x were observed at any time during the one hour run. At the conclusion of each baseline test, the solution temperature was ramped to 40 °C. No emissions were noted for one hour after the solution temperature stabilized at 40 °C. The sample results from the sodium nitrite makeup indicated a solution concentration of 39 weight percent. The pH of the 5 wt% antifoam solutions and the sodium nitrite solution was measured, as shown in Table 1. The pH of the sodium nitrite / antifoam mixtures taken at the conclusion of the runs is also shown in Table 1.

Table 1. Antifoam Test Conditions

	Antifoam	Antifoam Concentration	Sodium Nitrite Concentration	Run Temp	Solution pH	Result
		wt %	wt %	Celsius		
Sodium Nitrite Solution	-	-	39.03	-	9.26	-
Antifoam	Dow Corning 544	5.0	-	-	5.55	-
Antifoam	IIT 747	5.0	-	-	5.85	-
Run 1	Dow Corning 544	5.0	39.03	25	8.65*	No emissions
Run 1a	Dow Corning 544	5.0	39.03	40	8.65	No emissions
Run 2	IIT 747	5.0	39.03	25	9.12*	No emissions
Run 2a	IIT 747	5.0	39.03	40	9.12	No emissions

* Measured after the 40° C run.

CONCLUSIONS

Dow Corning 544 and IIT 747 antifoams did not generate NO_x when mixed with sodium nitrite under the conditions tested.

REFERENCES

1. Technical Task Request # HLW/DWPF/TTR-01-0023, Rate of NOx Gas Evolution with Sodium Nitrite and Boric Acid Solutions, Revision 1, September 6, 2001.
2. Task Technical and QA Plan # WSRC-RP-2001-00752, Rate of NOx Gas Evolution with Sodium Nitrite and Boric Acid Solutions, Revision 1, September 12, 2001.
3. M. E. Stone, Baseline Run Plan for Sodium Nitrite and Antifoam Mixing Tests (U), SRT-GDP-2001-00087, September 13, 2001.
4. M. E. Stone, Run Plan for Sodium Nitrite and Antifoam Mixing Tests at 40 Degrees Celsius (U), SRT-GDP-2001-00088, September 17, 2001.
5. Operation of Enerac 2000E NOx Analyzer, L27 – Procedure 2.04, June 9, 1998.
6. Boric Acid / Sodium Nitrite Test Laboratory Notebook, WSRC-NB-2001-00134.

APPENDIX A. EXPERIMENTAL APPARATUS