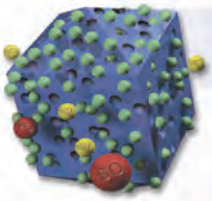


BICARB BULLETIN

Deacidification of Medical Waste Incinerator Gases with Sodium Bicarbonate

HCl Removal with Sodium Bicarbonate Injection at Swedish Medical Center, Seattle, WA

Case Background

This report highlights a process employed by Swedish Medical Center (SMC) in Seattle, Washington, to optimally reduce hydrogen chloride (HCl) emissions and other pollutants generated within the incineration process to comply with one of the world's most stringent air regulatory requirements.

SMC is a well-known 670-bed medical facility in a highly populated area. As part of its on-site medical waste incinerator operation, it relies on a dry sorbent injection-based air pollution control technology using ARM & HAMMER® Sorbent Grade Sodium Bicarbonate. This technology assures SMC safely maintains air emissions from incinerated infectious and innocuous wastes generated from its daily operations.

The SMC is a registered air emission source within the City of Seattle and is subject to air regulations under the Puget Sound Air Pollution Control Agency (PSAPCA). As part of its efforts to maintain emissions within regulatory limits, SMC uses a sophisticated continuous emissions monitoring system (CEMS) which features an HCl Analyzer as a guide to control emissions by adjusting waste and sorbent feed. In 1991, following its use and evaluation of other sorbent alternatives, SMC began using ARM & HAMMER® Sorbent Grade Sodium Bicarbonate. Since doing so, the average HCl removal rate at SMC is **98.5** percent (See Table 1 below).

Table 1: Swedish Medical Center stack test results (EPA method 26)

Stack Data	Run Number			
	1	2	3	Avg.
Volumetric Flow (ACFM)	3446.0	3687.1	3772.7	3635.3
Volumetric Flow (DSCFM)	1939.6	2070.1	2079.9	2029.9
Temperature (°F)	346.2	349.7	357.4	351.1
Moisture (Vol.%)	12.19	11.97	12.47	12.21
Particulate gr/dscf @ 7% O_2				
PM	0.008	0.013	0.005	0.009
Hydrogen Chloride @ 7% O_2				
Scrubber Inlet (ppm)	1671	1472	1526	1556.3
Stack (ppm)	16.5	21.1	30.2	22.6
HCl Removal Efficiency	99.0	98.6	98.0	98.5

Church & Dwight Co., Inc.
469 North Harrison Street • Princeton, New Jersey 08543-5297
Technical Service: 1-877-4BICARB (1-877-424-2272) • Sales: 1-800-221-0453
www.ahperformance.com

Deacidification of Medical Waste Incinerator Gases with Sodium Bicarbonate

System Description / Operation

SMC employs a professional engineering staff to operate its medical waste incinerator (MWI) and heat recovery boiler system. The staff runs the system continuously five days per week and initiates a five-hour burn-down early Saturday morning to allow the incinerator to cool for the remainder of the weekend. The operational cycle is reestablished each Monday after performing a "preventative maintenance" clean-up of the incinerator, boiler tubes and an inspection of the air ports and appropriate instrumentation.

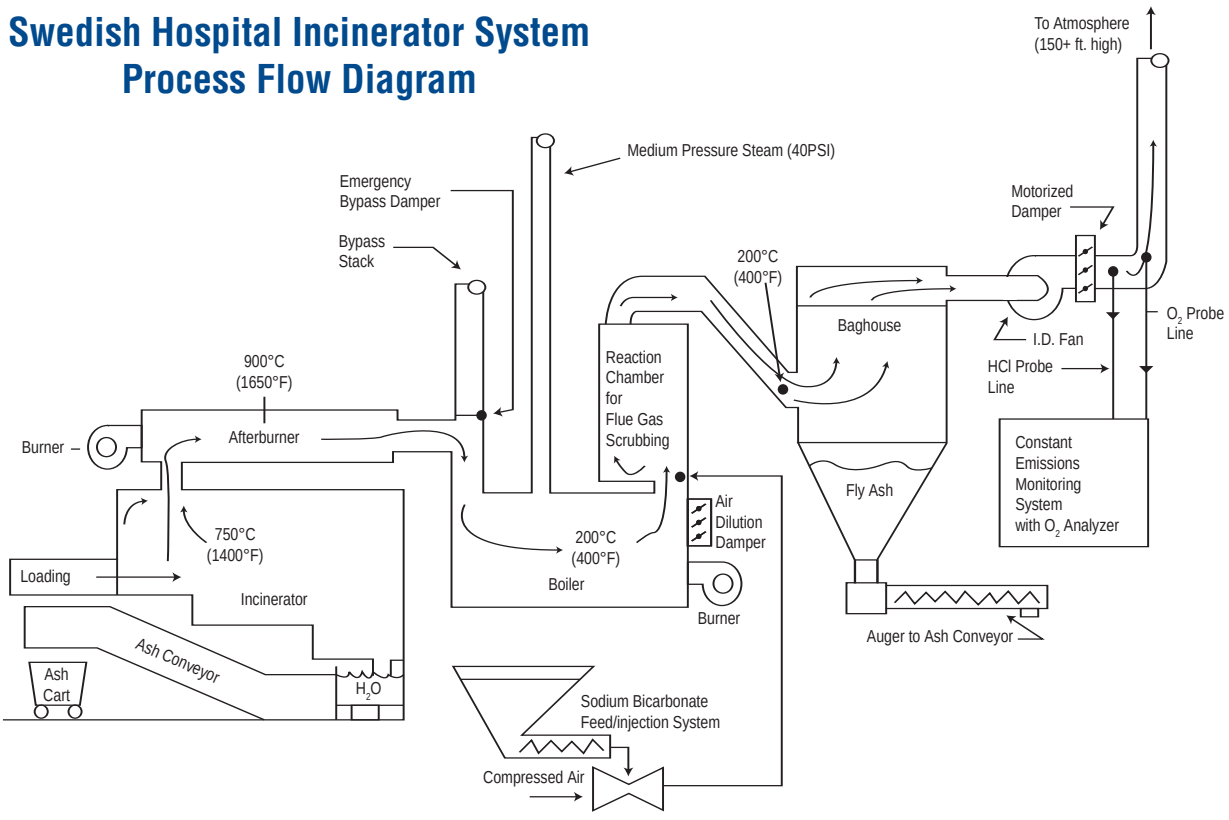
The facility incorporates an incinerator that is specified for an 800-pound-per-hour waste feed capacity with typical operating feed rates averaging 400 pounds per hour. Medical waste is manually fed into the 1400°F primary chamber for gasification. The flue gases are then discharged into the afterburner (secondary chamber) and are further heated to 1650°F using natural gas as an auxiliary fuel source. (Reference SMC plant flow diagram).

The flue gases are then discharged into a waste heat boiler for heat recovery and cooling in preparation for dry sorbent injection and APCD filtration.

The cooled boiler flue gas enters the reaction chamber at approximately 400°F where sodium bicarbonate ($NaHCO_3$) is metered and pneumatically injected into the waste gas stream. The combined flue gas and reactive sodium bicarbonate then enter the fabric filter at 400°F where further neutralization occurs and particulate matter is collected. The total surface area for flue gas filtration and absorption across 165 filter bags is approximately 2000 square feet.

Throughout the process, an SMC operator continually monitors the HCl Analyzer. If any rise in HCl readings occur, the waste feed rate is reduced while the sorbent feed is increased to enhance acid gas removal.

Swedish Hospital Incinerator System Process Flow Diagram



Deacidification of Medical Waste Incinerator Gases with Sodium Bicarbonate

System Description / Operation Continued…

The sorbent feed rate is adjusted manually to achieve response control. The HCl Analyzer readings are logged continuously and printed out in 5-minute intervals to maintain a 50 ppm (corrected for 7% O_2) time averaged hourly output. In addition to preventing emission spikes and maintaining consistent control, this technique enables SMC to utilize only that amount of sorbent necessary to achieve required emissions levels.

Sorbent Stoichiometry / Reaction Mechanism

Upon injection into the hot flue gas stream, sodium bicarbonate undergoes rapid thermal decomposition. This results in a highly porous, high surface area particle which has significant affinity to neutralize acidic emissions such as HCl. As particle porosity increases, acidic gases continually react with fresh reagent surface to achieve maximum scrubbing. Acid/base neutralization of HCl is represented in the following stoichiometric reaction:

$$NaHCO_3 + HCl \rightarrow NaCl + CO_2 + H_2O$$

Water vapor and carbon dioxide produced by this reaction vent to the atmosphere through the flue. The neutral salt reaction product (sodium chloride), along with the fly ash and unreacted sorbent, collect as filter cake on the fabric filters in the baghouse.

Results

Through injection of sodium bicarbonate, HCl emissions were reduced by an average of **98.5** percent based on Washington State certified stack test results (**Reference Table 1**). As a result, SMC operates its facility well within the compliance requirements of one of the world's most stringent air regulatory bodies, while maintaining environmentally sound operation.

Compared to other sorbents, sodium bicarbonate results in high utilization efficiencies, improved baghouse performance due to reduced pressure drop, and improved operational and mechanical reliability due to its non-corrosive, non-erosive nature. SMC also reports its fabric filter bags last longer due to the sodium bicarbonate's high level performance of acid gas neutralization.

At the same time, the lower spent sorbent volume reduces disposal costs and its negative environmental impact.

SMC's effective use of an HCl Analyzer is beneficial in monitoring and maintaining safe flue gas emissions levels by helping to control the waste feed rate, optimize sorbent utilization and prevent emission spikes.

Other notable advantages observed by SMC include the assurance of worker safety, easy-to-handle neutral salt by-products and improved particulate control device performance. While safety is always a prime necessity, SMC's use of sodium bicarbonate is especially beneficial because the incinerator is housed in a location of limited space.

The data and experience at SMC validates that by using ARM & HAMMER® Sorbent Grade Sodium Bicarbonate, a dry scrubber APCD can operate efficiently and effectively.