APOLLO
Corporation

Beta Study Report

Results of Nosocomial Infection Study In Whirlpool Bathing

REMEDY
UV INFECTION PROTECTION™

Germicidal Ultraviolet Light Purifying Technology

vs.

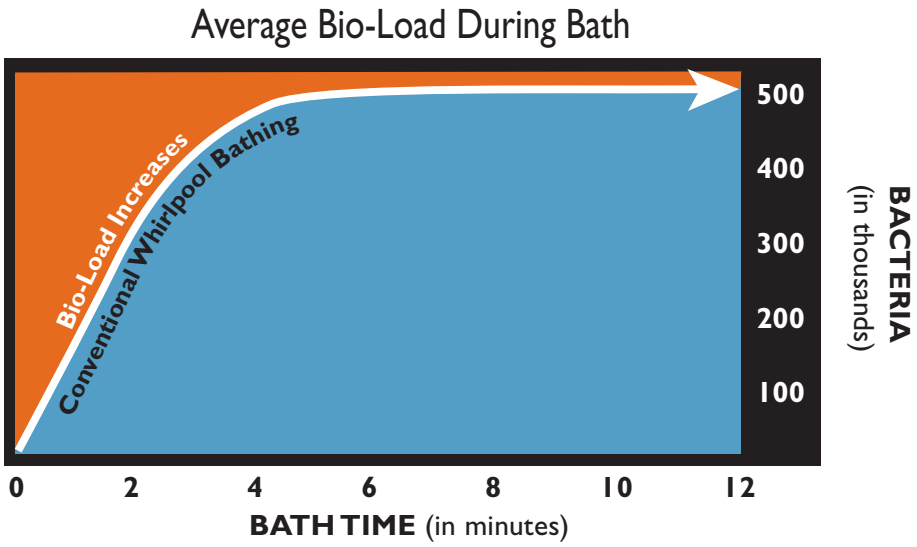
Traditional Chemical Disinfecting

Introduction

Apollo Corporation has designed a **Germicidal Ultraviolet Purifying Technology** called **Remedy®** to be used with whirlpool bathing systems in healthcare facilities. The bathing system is equipped with chambers housing germicidal ultraviolet (UV) light. When the whirlpool motor is activated, bath water is continuously recirculated through the UV chambers killing most micro-organisms upon exposure by destroying their DNA.

Studies Conducted

The Medical College of Pennsylvania in a 1986 study collected water samples at various intervals during several actual resident baths. Bacterial levels increased over 500,000 times during the course of these baths - **even though tubs had been chemically disinfected between uses** (Apollo's Beta Study corroborates the Medical College study.) Another study conducted by the EPA at about the same time reported that there are over 100 waterborne viruses in feces alone which can infect even at very low levels of exposure.



Apollo established two (2) major objectives for **Remedy:**

1. Eliminate the necessity to disinfect bath tubs with chemical disinfectants between uses by significantly reducing the level of bacteria in bath water during the bath.

2. Reduce the chances for contracting certain nosocomial infections.

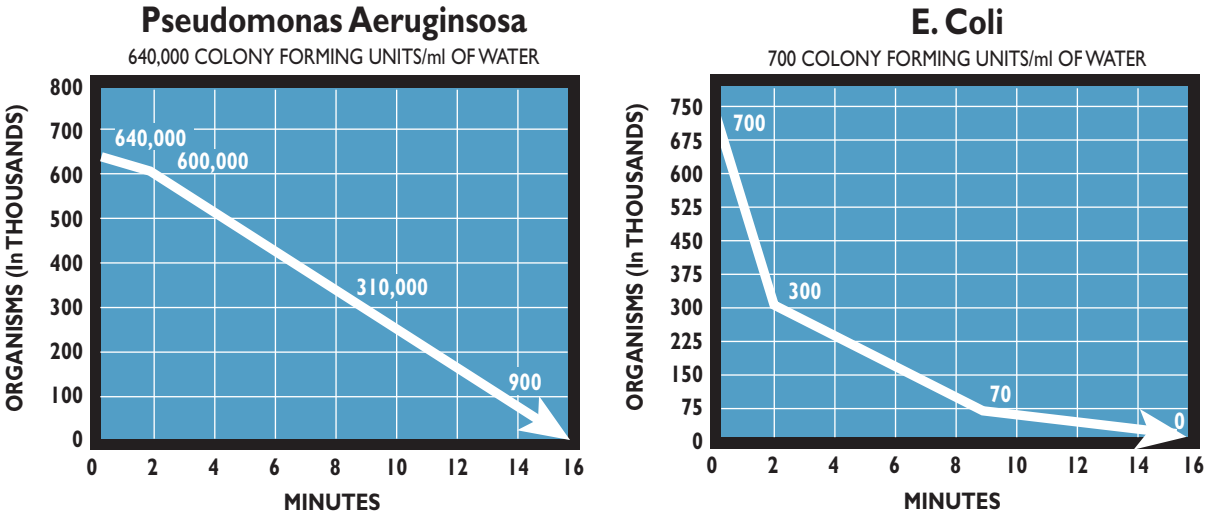
Reduction of Bacteria Using Remedy®

1) In Vitro Testing

In vitro testing was conducted by an independent, government recognized laboratory. No humans were used. Instead, measured numbers of two standard test organisms were introduced into a bath tub full of clean water. Water samples were taken at designated intervals as the water was continuously recirculated through Remedy's UV chambers by the whirlpool pump.

Results

Remedy worked as designed. By the end of the test period (as shown below), bacteria levels continually and dramatically declined as the water recirculated through Remedy's UV chambers. Up to 100% of the micro-organisms exposed to the germicidal ultraviolet light were killed.



2) Beta Study

Hundreds of bacteria samples were taken during actual resident baths from conventional whirlpool tubs (non-Remedy equipped) and Apollo whirlpool tubs equipped with Remedy. Several nursing home participated in a Beta Study. The tubs were cleaned for the next bath as follows.

Conventional whirlpools (non-Remedy) tubs were **chemically disinfected** between uses with brand name quaternary disinfectant/cleaners.

Remedy baths were **washed with a detergent**[1] **only** between baths and rinsed.

[1]Apollo's Power Clean™ (a non-disinfectant detergent cleaner).

Beta Study Confirms Remedy®'s Efficacy in Reducing Bacteria

Swab and Water Samples

Compare Disinfectant Cleaning vs. Detergent Cleaning

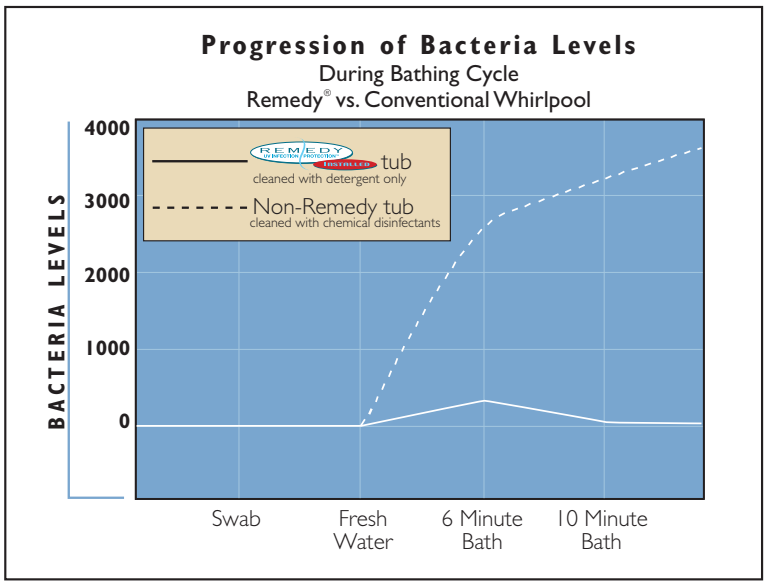
Swab samples (taken from Remedy baths after cleaning the tubs from the previous bath) and fresh water samples (taken before residents entered the bath) showed fewer bacteria present than samples from non-Remedy baths cleaned with hazardous chemical disinfectants. Remedy baths were cleaned only with a non-hazardous detergent[1]. It is interesting to note that very low and safe levels of bacteria were found in both Remedy and non-Remedy tubs.

Bacteria Levels Measured

Cleaning:	Conventional Whirlpools (Non-Remedy) Disinfectant	vs.	Remedy Bath Detergent[1]	
Swab Test: (5x5 cm)	**32** CFU/Sq.	vs.	**20** CFU/Sq.	(38% Fewer CFU)
Fresh Water	**50** CFU/ml $H_2 0$	vs.	**40** CFU/ml $H_2 0$	(20% Fewer CFU)
Baths:				
@ 6 minutes	**2,418** CFU/ml $H_2 0$	vs.	**443** CFU/ml $H_2 0$	(72% Fewer CFU)
@ 10 minutes	**2,822** CFU/ml $H_2 0$	vs.	**302** CFU/ml $H_2 0$	(89% Fewer CFU)

CFU = Colony Forming Units of Bacteria. Averages from all tests.

Bath water samples taken six (6) and ten (10) minutes after residents had entered the bath revealed dramatic increases in bacteria (82% and 89% more respectively) in non-Remedy tubs that had been chemically disinfected (see above). Chemical disinfecting did not prevent the bacteria increases during the bath. By contrast, Remedy tubs and detergent[1] cleaning reported bacteria levels so low that using a hazardous chemical disinfectant between baths was not necessary (confirmed above by Swab and Fresh Water tests on Remedy units).



Remedy's first objective was met:

Confirmed by In Vitro Laboratory and Beta Tests:

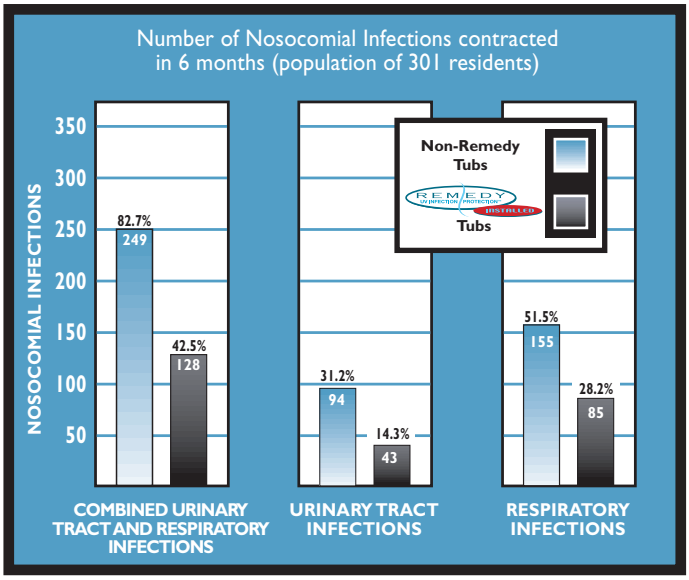
Remedy kills significant numbers of bacteria in the bath water and **eliminates** the need to use hazardous chemical disinfectants between baths.

Beta Study Further Shows Remedy® Reduces Chances for Infection

Results . . .

Beta Study reveals that Remedy bathers, exposed to fewer bacteria, contracted **fewer** urinary tract and respiratory nosocomial infections by nearly 50%*

Non-Remedy vs. Remedy



UTI Reductions

Of particular interest are the reports of **Urinary Tract Infections.** Non-Remedy users had a total of 94 (31.2% of the 301 total residents). **Remedy bathers contracted only 43, a percentage reduction of over 50%.** Respiratory Infections were higher among non-Remedy bathers also. 51.5% of non-Remedy bathers contracted nosocomial **Respiratory Infections** against just 28.2% of Remedy bathers, **a reduction of 45%.**

Beta Test nosocomial tracking results were very consistent throughout the test sites.

Beta study results strongly indicate that **Remedy has met its second design criteria** of significantly reducing chances for contracting nosocomial infections during the bath.

*Actual nosocomial infection records from the nursing homes participating in the Beta Study were provided. These were the same facilities where Swab, Fresh Water and six (6) and ten (10) minute water samples were taken. The resident census involved 301 people from several locations in different facilities bathed in conventional, non-Remedy whirlpools for six (6) months followed by six (6) months of bathing in a Remedy system. In some cases, the residents were the same. In situations where the same people were not bathed in both non-Remedy and Remedy units, residents were always very similar in type, condition and length of stay, etc. (e.g. all were long-term residents opposed to short-term, rehab, etc.). This Beta Study was completed March 15, 1996.

Labor to Treat Infections

Nursing homes participating in the Beta Study estimated the following nursing labor in hours to treat single infections.

- Urinary Tract Infections....15-20 Nursing Hours to treat
- Respiratory Infections.....4 - 5 Nursing Hours to treat

Results: By reducing infection rates, the staff has more time available for other care or nursing tasks.

Nosocomial Infections from Showering*

Two (2) additional locations provided nosocomial infection information for residents who were showered only. One (1) reported twenty-four (24) UTIs during a six (6) month period involving 132 residents, or 15.2% of the total population. The second reported seven (7) UTIs in a resident population of 25 people during six (6) months (28%). Combined UTIs in these two (2) facilities were twenty-seven (27) out of 157 residents (17.2%). **This compares to just 14% of Remedy® bathers participating in the Beta Study.**

Showering results for Urinary Tract Infections in both facilities were higher than Remedy's 14% average. **Remedy not only provides all the benefits of whirlpool bathing over showering, but beta test results show that Remedy bather contract fewer UTIs than those who were showered.**

*This data was not officially part of the Beta Study.

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