

Evaluation of Decontaminated N95 Respirators

Date Tested: 5/4/2020 – 5/7/2020

Respirator Model(s): 3M 8210, 3M 8210V, Moldex 1512, 3M 8000, Crosstex GPRN95

Tests: Filtration with NaCl (modified version of STP-0059), Manikin Fit Factor with Static Advanced Headform, and Strap Integrity with Tensile Testing

Decontamination Method: Vaporized Hydrogen Peroxide (VHP), 7%

Sealed Connex box with VHP system, 3-hour saturation environment with 24 hour exclusion/drying for biologic indicator result

Decontamination Cycles: 1, 2, 3, 4, and 5 cycles

While decontamination and reuse of FFRs are not consistent with standard and approved usage, these options may need to be considered when FFR shortages exist. This assessment was developed to quantify the filtration efficiency and manikin fit factor¹ of an N95 respirator that has been decontaminated. This assessment is not to determine the effectiveness of the decontamination procedure at killing pathogenic microorganisms. The results provided in this report are specific to the subset of samples that were provided to NPPTL for evaluation. These results may be used to update the CDC guidance for Crisis Capacity Strategies (during known shortages).

125 respirators that were unworn and not subjected to any pathogenic microorganisms were submitted for evaluation. This included 25 respirators that were subjected to 1 cycle of the VHP decontamination process, 25 respirators subjected to 2 cycles, 25 respirators subjected to 3 cycles, 25 respirators subjected to 4 cycles, and 25 respirators subjected to 5 cycles. No controls were provided. Figure 1 photos document the procedures used. The samples were tested using a modified version of the NIOSH Standard Test Procedure (STP) TEB-APR-STP-0059 to determine particulate filtration efficiency. The TSI, Inc. model 8130 using sodium chloride aerosol was used for the filtration evaluation. For the laboratory fit evaluation, a static manikin headform was used to quantify changes in manikin fit factor. The TSI, Inc. PortaCount® PRO+ 8038 in “N95 Enabled” mode was used for this evaluation. Additionally, tensile strength testing of the straps was performed to determine changes in strap integrity. The Instron® 5943 Tensile Tester was used for this evaluation. The full assessment plan can be found [here](#).

Filtration Efficiency Results: All respirator samples measured more than 95%. See Tables 1, 4, 7, 10, and 13.

Manikin Fit Factor Results: The manikin fit factor showed passing fit factors (greater than 100) for all samples at all provided decontamination cycles of the following models; 3M 8210, 3M 8210V, and Moldex 1512. The manikin fit test procedure used in this assessment did not show any detriments in fit associated with the decontamination method used for these models.

The 3M 8000 and Crosstex GPRN95 could not be reliably assessed for manikin fit, as the results after testing one sample of each showed manikin fit factors < 100. Because of the limited number of samples provided, the remaining samples for these models were not assessed for manikin fit. No controls were provided to confirm

¹The American Industrial Hygiene Association defines the Manikin Fit Factor as “An expression related to the amount of leakage measured through the face or neck seal of a respirator mounted to a manikin under specified airflow and environmental conditions. If the challenge to the seal is an airborne substance, it is the ratio of its airborne concentration outside the respirator divided by the concentration that enters the respirator through the seal. If the challenge is airflow or air pressure, conditions and assumptions for quantifying leakage must be specified. Leakage from other sources (e.g., air purifying elements) must be essentially zero. The respirator may be mounted to the manikin without sealants; be partially sealed to the manikin; or be sealed to the manikin with artificially induced leaks.”

whether the inadequate fit was due to the decontamination method or the respirator model itself. See Tables 2, 5, 8, 11, and 14.

Strap Integrity Results: No visual degradation of the straps was observed. Changes in strap tensile strength were not assessed, as no control respirators were provided. While the exact correlation between the force exerted by straps and fit is not well understood, higher force values may be associated with a tighter fit of the respirator to the face. Significant reductions in this force would be associated with a loss of elasticity of the straps, thereby reducing their ability to create a tight fit. See Tables 3, 6, 9, 12, and 15.



Figure 1. Laboratory Test Photos

Table 1. Filter Efficiency Evaluation – 3M 8210

Respirator Model, Decon Method, # of cycles	Treated Sample #	Flow Rate (Lpm)	Initial Filter Resistance (mmH ₂ O)	Initial Percent Leakage (%)	Maximum Percent Leakage (%)	Filter Efficiency (%)
3M 8210, VHP, 1 cycle Min Fil Eff: 97.26% Max Fil Eff: 99.53%	1	85	7.6	0.249	0.630	99.37
	2	85	6.8	2.23	2.47	97.53
	3	85	7.1	0.292	0.743	99.26
3M 8210, VHP, 2 cycles Min Fil Eff: 99.36% Max Fil Eff: 99.41%	1	85	7.4	0.238	0.643	99.36
	2	85	7.0	0.257	0.609	99.39
	3	85	7.3	0.196	0.594	99.41
3M 8210, VHP, 3 cycles Min Fil Eff: 97.60% Max Fil Eff: 99.50%	1	85	6.9	1.85	2.40	97.60
	2	85	7.7	0.577	0.675	99.33
	3	85	7.1	0.213	0.505	99.50
3M 8210, VHP, 4 cycles Min Fil Eff: 99.31% Max Fil Eff: 99.52%	1	85	7.4	0.171	0.480	99.52
	2	85	7.2	0.275	0.694	99.31
	3	85	7.1	0.253	0.646	99.35
3M 8210, VHP, 5 cycles Min Fil Eff: 99.09% Max Fil Eff: 99.49%	1	85	6.9	0.354	0.910	99.09
	2	85	7.1	0.200	0.510	99.49
	3	85	7.7	0.398	0.835	99.17

Notes:

- The test method utilized in this assessment is not the NIOSH standard test procedure that is used for certification of respirators. Respirators assessed to this modified test plan do not necessarily meet the requirements of STP-0059, and therefore cannot be considered equivalent to N95 respirators that were tested to STP-0059.

Table 2. Manikin Fit Evaluation – 3M 8210

Manikin Fit Factor of Decontaminated N95s					
Respirator Model, Decon Method, # of cycles	Treated Sample #	mFF Normal Breathing 1	mFF Deep Breathing	mFF Normal Breathing 2	Overall Manikin Fit Factor
3M 8210, VHP, 1 cycle Static Advanced Medium Headform (Hanson Robotics)	4	200+	200+	200+	200+
	5	200+	200+	200+	200+
3M 8210, VHP, 2 cycles Static Advanced Medium Headform (Hanson Robotics)	4	200+	200+	200+	200+
	5	200+	200+	200+	200+
3M 8210, VHP, 3 cycles Static Advanced Medium Headform (Hanson Robotics)	4	181	86	111	115
	5	200+	200+	200+	200+
3M 8210, VHP, 4 cycles Static Advanced Medium Headform (Hanson Robotics)	4	200+	195	200+	199
	5	200+	200+	200+	200+
3M 8210, VHP, 5 cycles Static Advanced Medium Headform (Hanson Robotics)	4	200+	200+	200+	200+
	5	200+	200+	200+	200+

Notes:

- Per [OSHA 1910.134\(f\)\(7\)](#), if the fit factor as determined through an OSHA-accepted quantitative fit testing protocol is equal to or greater than 100 for tight-fitting half facepieces, then the fit test has been passed for that respirator.
- This assessment does not include fit testing of people and only uses two exercises (normal and deep breathing) on a manikin headform.
- This assessment is a laboratory evaluation using a manikin headform and varies greatly from the OSHA individual fit test. This headform testing only includes normal breathing and deep breathing on a stationary (non-moving) headform; therefore, fit results from this assessment cannot be directly translated to using the standard OSHA-accepted test. Instead, this testing provides an indication of the change in fit performance (if any) associated with the decontamination of respirators.

Table 3. Strap Integrity Evaluation - 3M 8210

Tensile Force in Respirator Straps of Decontaminated N95s (recorded force values are at 150% strain)			
Respirator Model, Decon Method, # of cycles	Straps from Treated Sample #	Force in Top Strap (N)	Force in Bottom Strap (N)
3M 8210, VHP, 1 cycle	1	5.019	4.917
	2	5.073	4.834
	3	5.043	4.980
	Decontaminated Strap Average	5.045	4.910
	Control	N/A	N/A
	% Change ((Deconned - Controls) / Controls)	N/A	N/A
3M 8210, VHP, 2 cycles	1	5.083	5.012
	2	5.133	4.916
	3	5.000	4.952
	Decontaminated Strap Average	5.072	4.96
	Control	N/A	N/A
	% Change ((Deconned - Controls) / Controls)	N/A	N/A
3M 8210, VHP, 3 cycles	1	5.155	4.824
	2	4.982	4.852
	3	5.044	4.993
	Decontaminated Strap Average	5.060	4.890
	Control	N/A	N/A
	% Change ((Deconned - Controls) / Controls)	N/A	N/A
3M 8210, VHP, 4 cycles	1	5.133	4.985
	2	5.037	4.828
	3	5.051	4.892
	Decontaminated Strap Average	5.074	4.902
	Control	N/A	N/A
	% Change ((Deconned - Controls) / Controls)	N/A	N/A
3M 8210, VHP, 5 cycles	1	4.860	4.826
	2	5.001	4.851
	3	4.972	4.856
	Decontaminated Strap Average	4.944	4.844
	Control	N/A	N/A
	% Change ((Deconned - Controls) / Controls)	N/A	N/A

Table 4. Filter Efficiency Evaluation – 3M 8210V

Respirator Model, Decon Method, # of cycles	Treated Sample #	Flow Rate (Lpm)	Initial Filter Resistance (mmH₂O)	Initial Percent Leakage (%)	Maximum Percent Leakage (%)	Filter Efficiency (%)
3M 8210V, VHP, 1 cycle Min Fil Eff: 98.24% Max Fil Eff: 98.94%	1	85	8.5	1.30	1.76	98.24
	2	85	8.3	0.707	1.20	98.80
	3	85	8.5	0.642	1.06	98.94
3M 8210V, VHP, 2 cycles Min Fil Eff: 98.57% Max Fil Eff: 98.79%	1	85	8.3	0.783	1.21	98.79
	2	85	8.5	0.935	1.43	98.57
	3	85	8.3	0.946	1.40	98.60
3M 8210V, VHP, 3 cycles Min Fil Eff: 98.30% Max Fil Eff: 98.53%	1	85	8.3	1.12	1.70	98.30
	2	85	8.7	1.06	1.47	98.53
	3	85	8.4	1.13	1.58	98.42
3M 8210V, VHP, 4 cycles Min Fil Eff: 97.97% Max Fil Eff: 99.10%	1	85	8.4	1.00	1.48	98.52
	2	85	8.5	1.48	2.03	97.97
	3	85	9.9	0.435	0.904	99.10
3M 8210V, VHP, 5 cycles Min Fil Eff: 98.34% Max Fil Eff: 98.62%	1	85	10.0	1.34	1.38	98.62
	2	85	9.0	1.23	1.66	98.34
	3	85	8.8	1.04	1.60	98.40

Notes:

- The test method utilized in this assessment is not the NIOSH standard test procedure that is used for certification of respirators. Respirators assessed to this modified test plan do not necessarily meet the requirements of STP-0059, and therefore cannot be considered equivalent to N95 respirators that were tested to STP-0059.

Table 5. Manikin Fit Evaluation – 3M 8210V

Manikin Fit Factor of Decontaminated N95s					
Respirator Model, Decon Method, # of cycles	Treated Sample #	mFF Normal Breathing 1	mFF Deep Breathing	mFF Normal Breathing 2	Overall Manikin Fit Factor
3M 8210V, VHP, 1 cycle Static Advanced Medium Headform (Hanson Robotics)	4	200+	90	146	131
	5	200+	192	200+	198
3M 8210V, VHP, 2 cycles Static Advanced Medium Headform (Hanson Robotics)	4	200+	146	196	177
	5	200+	200+	200+	200+
3M 8210V, VHP, 3 cycles Static Advanced Medium Headform (Hanson Robotics)	4	200	123	200+	165
	5	200+	177	200+	192
3M 8210V, VHP, 4 cycles Static Advanced Medium Headform (Hanson Robotics)	4	200+	200+	200+	200+
	5	200+	200+	200+	200+
3M 8210V, VHP, 5 cycles Static Advanced Medium Headform (Hanson Robotics)	4	200+	200+	200+	200+
	5	200+	200+	200+	200+

Notes:

- Per [OSHA 1910.134\(f\)\(7\)](#), if the fit factor as determined through an OSHA-accepted quantitative fit testing protocol is equal to or greater than 100 for tight-fitting half facepieces, then the fit test has been passed for that respirator.
- This assessment does not include fit testing of people and only uses two exercises (normal and deep breathing) on a manikin headform.
- This assessment is a laboratory evaluation using a manikin headform and varies greatly from the OSHA individual fit test. This headform testing only includes normal breathing and deep breathing on a stationary (non-moving) headform; therefore, fit results from this assessment cannot be directly translated to using the standard OSHA-accepted test. Instead, this testing provides an indication of the change in fit performance (if any) associated with the decontamination of respirators.

Table 6. Strap Integrity Evaluation - 3M 8210V

Tensile Force in Respirator Straps of Decontaminated N95s (recorded force values are at 150% strain)			
Respirator Model, Decon Method, # of cycles	Straps from Treated Sample #	Force in Top Strap (N)	Force in Bottom Strap (N)
3M 8210V, VHP, 1 cycle	1	3.643	3.966
	2	3.743	3.938
	3	3.628	3.883
	Decontaminated Strap Average	3.671	3.929
	Control	N/A	N/A
	% Change ((Deconned - Controls) / Controls)	N/A	N/A
3M 8210V, VHP, 2 cycles	1	3.553	4.006
	2	3.486	3.847
	3	3.979	3.571
	Decontaminated Strap Average	3.673	3.808
	Control	N/A	N/A
	% Change ((Deconned - Controls) / Controls)	N/A	N/A
3M 8210V, VHP, 3 cycles	1	3.686	4.010
	2	3.661	3.721
	3	3.819	4.080
	Decontaminated Strap Average	3.722	3.937
	Control	N/A	N/A
	% Change ((Deconned - Controls) / Controls)	N/A	N/A
3M 8210V, VHP, 4 cycles	1	3.774	3.648
	2	3.863	3.702
	3	3.887	3.648
	Decontaminated Strap Average	3.841	3.666
	Control	N/A	N/A
	% Change ((Deconned - Controls) / Controls)	N/A	N/A
3M 8210V, VHP, 5 cycles	1	3.854	3.744
	2	3.849	3.813
	3	3.837	3.917
	Decontaminated Strap Average	3.847	3.825
	Control	N/A	N/A
	% Change ((Deconned - Controls) / Controls)	N/A	N/A

Table 7. Filter Efficiency Evaluation – Moldex 1512

Respirator Model, Decon Method, # of cycles	Treated Sample #	Flow Rate (Lpm)	Initial Filter Resistance (mmH ₂ O)	Initial Percent Leakage (%)	Maximum Percent Leakage (%)	Filter Efficiency (%)
Moldex 1512, VHP, 1 cycle Min Fil Eff: 97.91% Max Fil Eff: 98.79%	1	85	9.4	1.21	1.21	98.79
	2	85	9.5	1.96	1.96	98.04
	3	85	9.6	2.09	2.09	97.91
Moldex 1512, VHP, 2 cycles Min Fil Eff: 98.74% Max Fil Eff: 99.05%	1	85	9.9	0.950	0.950	99.05
	2	85	11.7	1.18	1.18	98.82
	3	85	10.1	1.26	1.26	98.74
Moldex 1512, VHP, 3 cycles Min Fil Eff: 97.80% Max Fil Eff: 98.59%	1	85	9.0	1.41	1.41	98.59
	2	85	9.7	1.67	1.67	98.33
	3	85	8.8	2.20	2.20	97.80
Moldex 1512, VHP, 4 cycles Min Fil Eff: 97.76% Max Fil Eff: 98.78%	1	85	8.8	2.24	2.24	97.76
	2	85	9.2	1.40	1.40	98.60
	3	85	9.3	1.22	1.22	98.78
Moldex 1512, VHP, 5 cycles Min Fil Eff: 97.55% Max Fil Eff: 98.74%	1	85	9.1	2.45	2.45	97.55
	2	85	9.4	1.87	2.27	97.73
	3	85	10.7	1.13	1.26	98.74

Notes:

- The test method utilized in this assessment is not the NIOSH standard test procedure that is used for certification of respirators. Respirators assessed to this modified test plan do not necessarily meet the requirements of STP-0059, and therefore cannot be considered equivalent to N95 respirators that were tested to STP-0059.

Table 8. Manikin Fit Evaluation – Moldex 1512

Manikin Fit Factor of Decontaminated N95s					
Respirator Model, Decon Method, # of cycles	Treated Sample #	mFF Normal Breathing 1	mFF Deep Breathing	mFF Normal Breathing 2	Overall Manikin Fit Factor
Moldex 1512, VHP, 1 cycle Static Advanced Medium Headform (Hanson Robotics)	4	200+	127	132	147
	5	200+	143	137	156
Moldex 1512, VHP, 2 cycles Static Advanced Medium Headform (Hanson Robotics)	4	200+	200+	200+	200+
	5	191	79	104	109
Moldex 1512, VHP, 3 cycles Static Advanced Medium Headform (Hanson Robotics)	4	200+	200+	200+	200+
	5	200+	200+	200+	200+
Moldex 1512, VHP, 4 cycles Static Advanced Medium Headform (Hanson Robotics)	4	200+	200+	200+	200+
	5	200+	200+	200+	200+
Moldex 1512, VHP, 5 cycles Static Advanced Medium Headform (Hanson Robotics)	4	200+	200+	200+	200+
	5	200+	200+	200+	200+

Notes:

- Per [OSHA 1910.134\(f\)\(7\)](#), if the fit factor as determined through an OSHA-accepted quantitative fit testing protocol is equal to or greater than 100 for tight-fitting half facepieces, then the fit test has been passed for that respirator.
- This assessment does not include fit testing of people and only uses two exercises (normal and deep breathing) on a manikin headform.
- This assessment is a laboratory evaluation using a manikin headform and varies greatly from the OSHA individual fit test. This headform testing only includes normal breathing and deep breathing on a stationary (non-moving) headform; therefore, fit results from this assessment cannot be directly translated to using the standard OSHA-accepted test. Instead, this testing provides an indication of the change in fit performance (if any) associated with the decontamination of respirators.

Table 9. Strap Integrity Evaluation - Moldex 1512

Tensile Force in Respirator Straps of Decontaminated N95s (recorded force values are at 150% strain)			
Respirator Model, Decon Method, # of cycles	Straps from Treated Sample #	Force in Top Strap (N)	Force in Bottom Strap (N)
Moldex 1512, VHP, 1 cycle	1	3.167	3.180
	2	3.150	3.196
	3	3.215	3.229
	Decontaminated Strap Average	3.177	3.202
	Control	N/A	N/A
	% Change ((Deconned - Controls) / Controls)	N/A	N/A
Moldex 1512, VHP, 2 cycles	1	3.198	3.279
	2	3.171	3.351
	3	3.133	3.341
	Decontaminated Strap Average	3.167	3.324
	Control	N/A	N/A
	% Change ((Deconned - Controls) / Controls)	N/A	N/A
Moldex 1512, VHP, 3 cycles	1	3.142	3.334
	2	3.204	3.309
	3	3.445	3.293
	Decontaminated Strap Average	3.264	3.312
	Control	N/A	N/A
	% Change ((Deconned - Controls) / Controls)	N/A	N/A
Moldex 1512, VHP, 4 cycles	1	3.208	3.148
	2	3.193	3.217
	3	3.341	3.371
	Decontaminated Strap Average	3.247	3.245
	Control	N/A	N/A
	% Change ((Deconned - Controls) / Controls)	N/A	N/A
Moldex 1512, VHP, 5 cycles	1	3.061	3.208
	2	3.078	3.179
	3	3.040	3.182
	Decontaminated Strap Average	3.060	3.190
	Control	N/A	N/A
	% Change ((Deconned - Controls) / Controls)	N/A	N/A

Table 10. Filter Efficiency Evaluation – 3M 8000

Respirator Model, Decon Method, # of cycles	Treated Sample #	Flow Rate (Lpm)	Initial Filter Resistance (mmH ₂ O)	Initial Percent Leakage (%)	Maximum Percent Leakage (%)	Filter Efficiency (%)
3M 8000, VHP, 1 cycle Min Fil Eff: 98.69% Max Fil Eff: 98.99%	1	85	14.0	0.880	1.01	98.99
	2	85	10.1	0.633	1.17	98.83
	3	85	10.3	0.585	1.14	98.86
	4	85	n/a*			
	5	85	9.9	0.712	1.31	98.69
3M 8000, VHP, 2 cycles Min Fil Eff: 98.33% Max Fil Eff: 99.05%	1	85	9.3	0.672	1.35	98.65
	2	85	9.8	0.688	1.25	98.75
	3	85	9.4	0.816	1.67	98.33
	4	85	11.0	0.518	0.961	99.04
	5	85	10.9	0.569	0.948	99.05
3M 8000, VHP, 3 cycles Min Fil Eff: 98.00% Max Fil Eff: 98.80%	1	85	9.9	0.583	1.23	98.77
	2	85	8.9	0.833	1.50	98.50
	3	85	9.4	1.27	2.00	98.00
	4	85	10.3	0.634	1.20	98.80
	5	85	9.6	0.833	1.41	98.59
3M 8000, VHP, 4 cycles Min Fil Eff: 98.74% Max Fil Eff: 99.18%	1	85	9.4	0.648	1.26	98.74
	2	85	10.7	0.835	1.23	98.77
	3	85	10.6	0.738	1.11	98.89
	4	85	11.3	0.559	0.987	99.01
	5	85	12.7	0.453	0.816	99.18
3M 8000, VHP, 5 cycles Min Fil Eff: 98.78% Max Fil Eff: 99.16%	1	85	11.6	0.841	1.09	98.91
	2	85	10.4	0.752	1.15	98.85
	3	85	10.1	0.751	1.22	98.78
	4	85	9.6	0.708	1.15	98.85
	5	85	11.1	0.571	0.844	99.16

*evaluated on manikin

Notes:

- The test method utilized in this assessment is not the NIOSH standard test procedure that is used for certification of respirators. Respirators assessed to this modified test plan do not necessarily meet the requirements of STP-0059, and therefore cannot be considered equivalent to N95 respirators that were tested to STP-0059.

Table 11. Manikin Fit Evaluation – 3M 8000

Manikin Fit Factor of Decontaminated N95s					
Respirator Model, Decon Method, # of cycles	Treated Sample #	mFF Normal Breathing 1	mFF Deep Breathing	mFF Normal Breathing 2	Overall Manikin Fit Factor
3M 8000*, VHP, 1 cycle Static Advanced Large Headform (Lunar Studios)	4	69	68	85	73

*Model unable to achieve adequate fit on manikin. Due to limited sample size, remaining samples were not assessed for manikin fit. Remaining samples for remaining cycles were assessed for filter penetration.

Notes:

- Per [OSHA 1910.134\(f\)\(7\)](#), if the fit factor as determined through an OSHA-accepted quantitative fit testing protocol is equal to or greater than 100 for tight-fitting half facepieces, then the fit test has been passed for that respirator.
- This assessment does not include fit testing of people and only uses two exercises (normal and deep breathing) on a manikin headform.
- This assessment is a laboratory evaluation using a manikin headform and varies greatly from the OSHA individual fit test. This headform testing only includes normal breathing and deep breathing on a stationary (non-moving) headform; therefore, fit results from this assessment cannot be directly translated to using the standard OSHA-accepted test. Instead, this testing provides an indication of the change in fit performance (if any) associated with the decontamination of respirators.
- **BOLD** overall manikin fit factor < 100.

Table 12. Strap Integrity Evaluation - 3M 8000

Tensile Force in Respirator Straps of Decontaminated N95s (recorded force values are at 150% strain)			
Respirator Model, Decon Method, # of cycles	Straps from Treated Sample #	Force in Top Strap (N)	Force in Bottom Strap (N)
3M 8000, VHP, 1 cycle	1	3.969	3.800
	2	4.040	3.887
	3	4.175	3.860
	Decontaminated Strap Average	4.061	3.849
	Control	N/A	N/A
	% Change ((Deconned - Controls) / Controls)	N/A	N/A
3M 8000, VHP, 2 cycles	1	4.149	3.938
	2	4.189	4.113
	3	4.167	4.018
	Decontaminated Strap Average	4.168	4.023
	Control	N/A	N/A
	% Change ((Deconned - Controls) / Controls)	N/A	N/A
3M 8000, VHP, 3 cycles	1	4.365	4.104
	2	4.286	4.144
	3	4.361	4.063
	Decontaminated Strap Average	4.337	4.104
	Control	N/A	N/A
	% Change ((Deconned - Controls) / Controls)	N/A	N/A
3M 8000, VHP, 4 cycles	1	3.970	4.090
	2	4.186	3.986
	3	4.328	3.875
	Decontaminated Strap Average	4.161	3.984
	Control	N/A	N/A
	% Change ((Deconned - Controls) / Controls)	N/A	N/A
3M 8000, VHP, 5 cycles	1	4.267	4.011
	2	4.370	4.069
	3	4.348	3.932
	Decontaminated Strap Average	4.328	4.004
	Control	N/A	N/A
	% Change ((Deconned - Controls) / Controls)	N/A	N/A

Table 13. Filter Efficiency Evaluation – Crosstex GPRN95

Respirator Model, Decon Method, # of cycles	Treated Sample #	Flow Rate (Lpm)	Initial Filter Resistance (mmH ₂ O)	Initial Percent Leakage (%)	Maximum Percent Leakage (%)	Filter Efficiency (%)	
Crosstex GPRN95, VHP, 1 cycle Min Fil Eff: 99.09% Max Fil Eff: 99.66%	1	85	7.5	0.337	0.337	99.66	
	2	85	6.8	0.557	0.736	99.26	
	3	85	6.4	0.586	0.912	99.09	
	4	85	n/a*				
	5	85	7.9	0.598	0.623	99.38	
Crosstex GPRN95, VHP, 2 cycles Min Fil Eff: 99.03% Max Fil Eff: 99.62%	1	85	6.7	0.783	0.783	99.22	
	2	85	6.9	0.384	0.384	99.62	
	3	85	6.5	0.916	0.967	99.03	
	4	85	6.3	1.04	1.07	98.93	
	5	85	6.4	0.913	0.922	99.08	
Crosstex GPRN95, VHP, 3 cycles Min Fil Eff: 97.85% Max Fil Eff: 99.28%	1	85	6.4	0.423	0.725	99.28	
	2	85	6.2	1.12	1.20	98.80	
	3	85	6.2	1.12	1.16	98.84	
	4	85	6.0	2.11	2.15	97.85	
	5	85	6.2	1.93	2.05	97.95	
Crosstex GPRN95, VHP, 4 cycles Min Fil Eff: 96.78% Max Fil Eff: 99.22%	1	85	6.2	1.50	1.54	98.46	
	2	85	6.2	2.32	2.38	97.62	
	3	85	6.3	2.00	2.08	97.92	
	4	85	6.3	2.75	3.22	96.78	
	5	85	6.3	0.712	0.777	99.22	
Crosstex GPRN95, VHP, 5 cycles Min Fil Eff: 96.84% Max Fil Eff: 99.13%	1	85	6.4	1.97	2.00	98.00	
	2	85	6.5	1.04	1.05	98.95	
	3	85	6.3	2.70	3.16	96.84	
	4	85	6.6	0.825	0.870	99.13	
	5	85	6.2	1.44	1.47	98.53	

*evaluated on manikin

Notes:

- The test method utilized in this assessment is not the NIOSH standard test procedure that is used for certification of respirators. Respirators assessed to this modified test plan do not necessarily meet the requirements of STP-0059, and therefore cannot be considered equivalent to N95 respirators that were tested to STP-0059.

Table 14. Manikin Fit Evaluation – Crosstex GPRN95

Manikin Fit Factor of Decontaminated N95s					
Respirator Model, Decon Method, # of cycles	Treated Sample #	mFF Normal Breathing 1	mFF Deep Breathing	mFF Normal Breathing 2	Overall Manikin Fit Factor
Crosstex GPRN95*, VHP, 1 cycle Static Advanced Large Headform (Lunar Studios)	4	6	5	6	5

*Model unable to achieve adequate fit on manikin. Due to limited sample size, remaining samples were not assessed for manikin fit. Remaining samples for remaining cycles were assessed for filter penetration.

Notes:

- Per [OSHA 1910.134\(f\)\(7\)](#), if the fit factor as determined through an OSHA-accepted quantitative fit testing protocol is equal to or greater than 100 for tight-fitting half facepieces, then the fit test has been passed for that respirator.
- This assessment does not include fit testing of people and only uses two exercises (normal and deep breathing) on a manikin headform.
- This assessment is a laboratory evaluation using a manikin headform and varies greatly from the OSHA individual fit test. This headform testing only includes normal breathing and deep breathing on a stationary (non-moving) headform; therefore, fit results from this assessment cannot be directly translated to using the standard OSHA-accepted test. Instead, this testing provides an indication of the change in fit performance (if any) associated with the decontamination of respirators.
- **BOLD** overall manikin fit factor < 100.

Table 15. Strap Integrity Evaluation - Crosstex GPRN95

Tensile Force in Respirator Straps of Decontaminated N95s (recorded force values are at 150% strain)			
Respirator Model, Decon Method, # of cycles	Straps from Treated Sample #	Force in Top Strap (N)	Force in Bottom Strap (N)
Crosstex GPRN95, VHP, 1 cycle	1	0,757	0.748
	2	1.037	1.079
	3	1.052	1.169
	Decontaminated Strap Average	0.949	0.999
	Control	N/A	N/A
	% Change ((Deconned - Controls) / Controls)	N/A	N/A
Crosstex GPRN95, VHP, 2 cycles	1	0.771	0.751
	2	0.744	0.734
	3	0.657	0.674
	Decontaminated Strap Average	0.724	0.720
	Control	N/A	N/A
	% Change ((Deconned - Controls) / Controls)	N/A	N/A
Crosstex GPRN95, VHP, 3 cycles	1	0.504	0.658
	2	0.483	0.638
	3	0.678	0.660
	Decontaminated Strap Average	0.555	0.652
	Control	N/A	N/A
	% Change ((Deconned - Controls) / Controls)	N/A	N/A
Crosstex GPRN95, VHP, 4 cycles	1	0.591	0.647
	2	0.641	0.655
	3	0.521	0.656
	Decontaminated Strap Average	0.584	0.653
	Control	N/A	N/A
	% Change ((Deconned - Controls) / Controls)	N/A	N/A
Crosstex GPRN95, VHP, 5 cycles	1	0.530	0.655
	2	0.700	0.687
	3	0.680	0.708
	Decontaminated Strap Average	0.637	0.683
	Control	N/A	N/A
	% Change ((Deconned - Controls) / Controls)	N/A	N/A