

# North American Nonwovens Industry Outlook, 2019-2024

A Review and Forecast of the North American Nonwovens  
Supply and Demand for 2014, 2019 and 2024



**Association of the  
Nonwoven Fabrics Industry**

ADVANCING ENGINEERED MATERIAL SOLUTIONS

P.O. Box 1288, Cary, North Carolina 27512-1288, U.S.A.

1100 Crescent Green, Suite 115, Cary, North Carolina 27518, U.S.A.

Tel: (919) 459-3700

Web: [www.inda.org](http://www.inda.org)

**Copyright© 2020 INDA, Association of the Nonwoven Fabrics Industry.**

All rights reserved. This material may not be reproduced, in whole or in part, in any medium whatsoever, without the express written permission of INDA, Association of the Nonwoven Fabrics Industry.

INDA is a registered trademark of INDA, Association of the Nonwoven Fabrics Industry.

## Foreword

This is INDA's eleventh report analyzing the nonwovens industry of North America. This report presents detailed supply and demand data for the North American nonwovens industry for 2014 and 2019, and a forecast for 2024. Specifically, the goals of the report were to:

- Provide baseline economic and demographic trends, as they are significant drivers of demand within the North American nonwovens industry;
- Develop industry consumption figures by sales, units, square meters, and tonnage for nonwoven materials in 11 end use markets and their numerous subcategories (262) for 2014 and 2019, and provide a forecast for 2024;
- Explain industry trends within the end-use markets;
- Provide an overall picture of the North American supply side by analyzing the key metrics of capacity (1990–2019), production including operating rates (2009–2019), and trade flow data (2009–2019); and
- Define and clarify end use market segmentation and production processes to provide greater precision in categorizing the industry.

INDA has undertaken this study to fulfill the element of its mission to **provide credible statistics to its members and the overall industry**. This information is intended to assist those in the nonwovens industry in making better business decisions. While no study is perfect, INDA has devoted considerable time, knowledge, reach, and resources to make this the most accurate and **most comprehensive analysis** of the total North American nonwovens industry.

It is INDA's intention to continue to improve the quality of data and industry information with each report. Your comments are welcome on information you would like included in future reports of the nonwoven industry in North America. Please feel free to contact either of us regarding any aspect of this report.



Dave Rousse, President  
INDA, Association of the Nonwoven Fabrics Industry  
drousse@inda.org  
919.459.3730



Brad Kalil, Director of Market Research and Statistics  
INDA, Association of the Nonwoven Fabrics Industry  
bkalil@inda.org  
919.459.3734



## TABLE OF CONTENTS

<b>I. Executive Summary .....</b>	<b>I</b>
<b>II. Economic and Population Drivers.....</b>	<b>7</b>
A. North American Economic Growth.....	8
1. United States.....	9
2. Canada.....	11
3. Mexico.....	12
4. Country Comparison.....	13
B. North American Population.....	16
1. Age Cohorts .....	18
Babies and Toddlers (Age 0 – 4 Years).....	18
Females Age 13 – 51 .....	21
The Elderly (65+).....	23
Population Pyramids .....	24
<b>III. North American Nonwoven Demand.....</b>	<b>26</b>
A. Disposable Applications Demand.....	34
1. Absorbent Hygiene .....	43
Consumer .....	46
Baby Diapers and Training Pants.....	49
Incontinence Products .....	56
Feminine Care .....	65
Institutional.....	70
2. Filtration .....	75
Air Filtration .....	83
Industrial Air .....	88
Transportation.....	92
Commercial Air Systems .....	97

Residential Locations .....	100
Personal Protection .....	104
Vacuum Cleaner Bags.....	108
Liquid Filtration .....	110
Transportation .....	113
Industrial / Manufacturing.....	116
Water .....	117
Biotechnology/ Pharmaceuticals.....	117
3. Wipes .....	119
Consumer Wipes .....	126
Baby .....	130
Home Care.....	133
Personal Care.....	141
Industrial and Institutional Wipes .....	148
Industrial/Commercial: General .....	152
Industrial: Specialty.....	155
Institutional: Food Service and Hospitality.....	159
Institutional: Healthcare/Medical .....	162
4. Medical/Surgical .....	167
Surgical Packs and Gowns.....	178
Other Apparel .....	181
Sterile Packaging/Sterilization Wrap.....	183
Wound Care.....	185
5. Other Disposable Applications .....	188
Personal Protective Equipment.....	189
Sorbents .....	192
Cleaning/Scrub and Abrasive/Polishing Discs/Pads .....	193
Packaging .....	194
B. Durable Applications Demand .....	197
1. Vehicle Construction.....	205
Light Vehicle Sales .....	209

---

Light Vehicle Production .....	212
Nonwovens in Vehicle Construction .....	220
Other Transportation Modes.....	227
2. Building Construction.....	229
Building Construction Markets — Residential & Nonresidential..	230
New Residential Starts .....	232
New and Existing-Home Sales... Repair & Remodel.....	235
Nonresidential-Building Construction .....	242
Nonwovens in Building Construction.....	244
Roofing .....	247
Underlayment .....	251
Other Building Construction Materials .....	253
3. Home and Office Furnishings.....	256
Floor Coverings .....	261
Woven and Tufted Carpet Backing.....	262
Underpads/Underlay and Floor Protectors.....	265
Floor Entrance/Walk-Off Mats.....	265
Upholstered Furnishing.....	267
Bedding .....	269
Other Furnishings.....	273
4. Geosynthetics .....	278
Civil Engineering.....	281
Geotextiles for Road Applications .....	284
Geotextiles for Other Applications .....	287
Cured-in-Place Pipe .....	292
Agriculture.....	294
Agricultural Crop Covers/Shading.....	295
Landscape Fabrics .....	297
Root Bags .....	297
5. Apparel.....	299
6. Other Durable Applications.....	306

<b>IV. North American Nonwovens Supply .....</b>	<b>311</b>
A. Capacity.....	311
1. Historical Perspective.....	312
2. Previous Years' Comparisons .....	314
B. Production .....	321
1. Historical Perspective.....	321
2. Previous Years' Comparisons .....	325
3. Production by End-Use Market .....	329
4. Production by Raw Material Usage.....	330
Spunlaid Resins .....	331
Staple Fiber Based .....	333
C. Trade Flows.....	335
1. United States Trade .....	337
2. North American Intra-Region Trade.....	340
Mexico .....	340
Canada .....	343
3. North America Inter-Region Trade .....	347
Exports .....	347
Imports .....	352
D. Overall North American Trade Flows.....	358
1. Intra-Region Trade.....	358
2. Inter-Region Trade .....	359
<b>V. Final Thoughts and Outlook Summary .....</b>	<b>360</b>
<b>VI. Appendix.....</b>	<b>361</b>
A. Methodology.....	361
1. Demand Model.....	361



---

2. Supply Model.....	364
B. Nonwoven Material Definitions .....	365
1. Nonwoven Definition .....	365
2. Forming Processes .....	365
Drylaid.....	365
Spunlaid .....	367
Wetlaid .....	368
Airlaid Short Fiber.....	368
C. Nonwoven End Use Classifications and Definitions .....	369
1. Disposables .....	369
2. Durables.....	372

## LIST OF FIGURES

### II. Economic and Population Drivers

II-1	Relative Sizes of North American Economies, 2019 .....	8
II-2	Annual Growth of Real GDP in the United States, 2015–2024.....	9
II-3	Annual Growth of Real GDP in Canada, 2015–2024.....	11
II-4	Annual Growth of Real GDP in Mexico, 2015–2024.....	13
II-5	North American Real GDP Annual Growth by Country, 2015–2024.....	14
II-6	Relative Sizes of North American Populations, 2019.....	16
II-7	North American Population by Country, Historical and Forecast.....	17
II-8	Total Number of U.S. and Canada Births, Actual 1950-2019 .....	19
II-9	Total Number of Babies and Toddlers (0–4 Years) by Country, Historical and Forecast.....	21
II-10	Total Number Females (13–51 Years) by Country, Historical and Forecast .....	22
II-11	Total Population and Elderly (65+ Years) by Country, Historical and Forecast....	23
II-12	U.S./Canada Population Pyramid, 2014 .....	24
II-13	Mexico Population Pyramid, 2014.....	24
II-14	U.S./Canada Population Pyramid, 2019 .....	25
II-15	Mexico Population Pyramid, 2019.....	25
II-16	U.S./Canada Population Pyramid, 2024f.....	25
II-17	Mexico Population Pyramid, 2024f.....	25

### III. North American Nonwoven Demand

III-1	North American Nonwovens Market, Dollar Sales, 2019.....	27
III-2	North American Nonwovens Market, Square Meters, 2019 .....	28
III-3	North American Nonwovens Market, Tonnage, 2019 .....	28
III-4	North American Nonwoven Material Consumption, 2019 .....	29
III-5	North American Nonwoven Material Consumption, Historical and Forecast.....	30
III-6	North American Nonwovens Square Meters Usage Market Sizes and Growth.....	32

III-7	North American Nonwovens Tonnage Usage Market Sizes and Growth.....	33
-------	---	----

### **IIIA. Disposable Applications Demand**

IIIA-1	North American Disposable Nonwovens Market, End-Use Dollar Sales, Historical and Forecast.....	34
IIIA-2	North American Disposable Nonwovens Market, End-Use Unit Sales, Historical and Forecast.....	37
IIIA-3	Disposable Nonwoven Material Consumption by End-Use, 2019 .....	38
IIIA-4	Disposable Nonwoven Material Consumption, Historical and Forecast .....	40
IIIA-5	North American Disposable Nonwovens Square Meter Usage Market Sizes and Growth by End-Use.....	41
IIIA-6	North American Disposable Nonwovens Tonnage Usage Market Sizes and Growth by End-Use.....	42
IIIA-7	North American Absorbent Hygiene Market, Category Dollar Sales, Historical and Forecast.....	45
IIIA-8	North American Absorbent Hygiene Market, Category Unit Sales, Historical and Forecast.....	48
IIIA-9	Consumer Absorbent Hygiene Nonwoven Material Consumption by Category, 2019 .....	49
IIIA-10	Total Number of U.S. Births, 1950–2024f .....	50
IIIA-11	Total Potential Children in Diapers, United States and Canada, Historical and Forecast.....	51
IIIA-12	Total Potential Children in Diapers, Mexico, Historical and Forecast.....	51
IIIA-13	Disposable Baby Diapers and Training Pants Demand, Units, Historical and Forecast.....	53
IIIA-14	Baby Diapers and Training Pants Nonwoven Material Consumption, Historical and Forecast.....	56
IIIA-15	Adult Population (18–64 years and Non-Institutionalized 65+ years) Total Population and Population Impacted by Incontinence Issues.....	59
IIIA-16	Adult Population (18–64 years and Non-Institutionalized 65+ years) Impacted by Incontinence Issues and Product Usage .....	61
IIIA-17	North American Consumer Incontinence Market, Category Unit Sales, Historical and Forecast.....	63

IIIA-18	Consumer Incontinence Product Material Consumption, Historical and Forecast.....	64
IIIA-19	Female Population (13-51 years) Total Population and Disposable Feminine Care Product Usage .....	65
IIIA-20	Disposable Feminine Care Product Demand, Units, Historical and Forecast.....	66
IIIA-21	Consumer Feminine Care Product Material Consumption, Historical and Forecast.....	69
IIIA-22	Institutionalized Adult Population (65+ years) Total Population and Population Impacted by Incontinence Issues.....	71
IIIA-23	North American Institutionalized Incontinence Market, Category Unit Sales, Historical and Forecast.....	72
IIIA-24	Institutional Absorbent Hygiene Product Material Consumption, Historical and Forecast.....	74
IIIA-25	North American Filtration Market, Segment Dollar Sales, Historical and Forecast.....	80
IIIA-26	Filtration Nonwoven Material Consumption, Historical and Forecast.....	81
IIIA-27	North American Air Filtration Market, Category Unit Sales, Historical and Forecast.....	85
IIIA-28	Air Filtration Nonwoven Material Consumption by Category, 2019 .....	87
IIIA-29	Air Filtration Nonwoven Material Consumption, Historical and Forecast .....	88
IIIA-30	Industrial/Manufacturing Air Filtration Nonwoven Material Consumption, Historical and Forecast.....	92
IIIA-31	Transportation Air Filtration Nonwoven Material Consumption, Historical and Forecast.....	96
IIIA-32	Commercial Air Systems Air Filtration Nonwoven Material Consumption Historical and Forecast.....	100
IIIA-33	Residential Locations Air Filtration Nonwoven Material Consumption Historical and Forecast.....	104
IIIA-34	Personal Protection Air Filtration Nonwoven Material Consumption, Historical and Forecast.....	107
IIIA-35	Vacuum Cleaner Air Filtration Nonwoven Material Consumption, Historical and Forecast.....	109
IIIA-36	Liquid Filtration Nonwoven Material Consumption by Category, 2019.....	114

IIIA-37	Liquid Filtration Nonwoven Material Consumption, Historical and Forecast .....	115
IIIA-38	North American Wipes Market Dollar Sales to End Users, 2019 .....	120
IIIA-39	North American Wipes Market Unit Sales to End Users, 2019 .....	120
IIIA-40	North American Wipes Market, Segment Dollar Sales, Historical and Forecast.	123
IIIA-41	North American Wipes Market, Segment Unit Sales, Historical and Forecast....	124
IIIA-42	Wipes Nonwoven Material Consumption, Historical and Forecast.....	125
IIIA-43	North American Consumer Wipes Market, Category Dollar Sales, Historical and Forecast.....	127
IIIA-44	North American Consumer Wipes Market, Category Unit Sales, Historical and Forecast.....	128
IIIA-45	Consumer Wipes Nonwoven Material Consumption by Category, 2019.....	130
IIIA-46	North American Baby Wipes Market, Category Unit Sales, Historical and Forecast.....	132
IIIA-47	Baby Wipes Nonwoven Material Consumption, Historical and Forecast .....	133
IIIA-48	North American Home Care Wipes Market, Category Unit Sales, Historical and Forecast.....	135
IIIA-49	Home Care Wipes Nonwoven Material Consumption, Historical and Forecast...	137
IIIA-50	North American Personal Care Wipes Market, Category Unit Sales, Historical and Forecast.....	142
IIIA-51	Personal Care Wipes Nonwoven Material Consumption, Historical and Forecast.....	144
IIIA-52	North American Industrial/Institutional Wipes Market, Category Unit Sales, 2019 .....	148
IIIA-53	North American Industrial/Institutional Wipes Market, Category Dollar Sales Historical and Forecast.....	150
IIIA-54	North American Industrial/Institutional Wipes Market, Category Unit Sales, Historical and Forecast.....	150
IIIA-55	Industrial/Institutional Wipes Nonwoven Material Consumption by Category, 2019 .....	152
IIIA-56	North American General Industrial/Commercial Wipes Market, Unit Sales, Historical and Forecast.....	153
IIIA-57	General Industrial/Commercial Wipes Nonwoven Material Consumption, Historical and Forecast.....	154

IIIA-58	North American Specialty Industrial Wipes Market, Category Unit Sales, Historical and Forecast.....	157
IIIA-59	Specialty Industrial Wipes Nonwoven Material Consumption, Historical and Forecast.....	158
IIIA-60	North American Institutional Food Service & Hospitality Wipes Market Unit Sales, Historical and Forecast.....	159
IIIA-61	Food Service & Hospitality Wipes Nonwoven Material Consumption, Historical and Forecast.....	162
IIIA-62	North American Institutional Healthcare/Medical Wipes Market, Category Unit Sales, Historical and Forecast.....	164
IIIA-63	Institutional Healthcare/Medical Wipes Nonwoven Material Consumption Historical and Forecast.....	166
IIIA-64	North American Disposable Medical/Surgical Market, Category Dollar Sales, 2019.....	169
IIIA-65	National and State Healthcare-Associated Infections Progress Report, 2016.....	174
IIIA-66	Medical/Surgical Nonwoven Material Consumption by Category, 2019 .....	175
IIIA-67	North American Medical/Surgical Market, Category Dollar Sales, Historical and Forecast.....	176
IIIA-68	Medical/Surgical Nonwoven Material Consumption, Historical and Forecast....	178
IIIA-69	Surgical Packs and Gowns Nonwoven Material Consumption, Historical and Forecast.....	180
IIIA-70	Medical and Surgical Other Apparel Nonwoven Material Consumption, Historical and Forecast.....	182
IIIA-71	Medical and Surgical Sterile Packaging and Sterilization Wrap Nonwoven Material Consumption, Historical and Forecast.....	184
IIIA-72	Medical and Surgical Wound Care Nonwoven Material Consumption, Historical and Forecast.....	187
IIIA-73	North American Other Disposable Applications Market, Category Dollar Sales, Historical and Forecast.....	190
IIIA-74	Other Disposable Applications Nonwoven Material Consumption, Historical and Forecast.....	196

**IIIB. Durable Applications Demand**

IIIB-1	North American Durable Nonwovens Market, End-Use Tonnage Consumption, Historical and Forecast .....	199
IIIB-2	North American Durable Nonwovens Market, End-Use Square Meter Consumption, Historical and Forecast.....	200
IIIB-3	Durable Nonwoven Material Consumption by End-Use, 2019 .....	201
IIIB-4	Durable Nonwoven Material Consumption, Historical and Forecast.....	202
IIIB-5	North American Durable Nonwovens Tonnage Usage Market Sizes and Growth by End-Use, .....	203
IIIB-6	North American Durable Nonwovens Square Meter Usage Market Sizes and Growth by End-Use.....	204
IIIB-7	Vehicle Construction Nonwoven Material Consumption by Category, 2019.....	207
IIIB-8	Vehicle Construction Nonwoven Material Consumption, Historical and Forecast.....	208
IIIB-9	North American Vehicle Sales, Historical and Forecast .....	210
IIIB-10	North American Light Vehicle Production, Historical and Forecast .....	213
IIIB-11	Vehicle Construction Automobiles and Light Truck Nonwoven Material Consumption, Historical and Forecast.....	225
IIIB-12	Vehicle Construction - Other Transportation Modes Nonwoven Material Consumption, Historical and Forecast.....	228
IIIB-13	United States Value of Building Construction Put in Place, 2002–2019 .....	231
IIIB-14	U.S. and Canada New Residential Construction Annual Starts, 2000–2019 .....	233
IIIB-15	U.S. and Canada New Residential Starts, Historical and Forecast .....	234
IIIB-16	U.S. Housing Sales, 2000–2019 .....	237
IIIB-17	U.S. Housing Sales, Historical and Forecast .....	238
IIIB-18	U.S. Home Improvement and Repair Spending, Historical and Forecast .....	240
IIIB-19	U.S. Home Improvement Spending, 2014–2019 .....	241
IIIB-20	United States Value of Nonresidential Building Construction Put in Place, Historical and Forecast.....	242
IIIB-21	Building Construction Nonwoven Material Consumption by Category, 2019 .....	244

---

IIIB-22	Building Construction Nonwoven Material Consumption, Historical and Forecast.....	246
IIIB-23	Building Construction – Roofing Nonwoven Material Consumption, Historical and Forecast.....	249
IIIB-24	Building Construction – Underlayment Nonwoven Material Consumption, Historical and Forecast.....	252
IIIB-25	Building Construction – Other Materials Nonwoven Material Consumption, Historical and Forecast.....	255
IIIB-26	U.S. Real Gross Domestic Product Components, Historical and Forecast .....	258
IIIB-27	Home and Office Furnishings Nonwoven Material Consumption by Category, 2019 .....	260
IIIB-28	Home and Office Furnishings Nonwoven Material Consumption, Historical and Forecast.....	261
IIIB-29	Home and Office Furnishings - Floor Coverings Nonwoven Material Consumption by Category, 2019.....	263
IIIB-30	Home and Office Furnishings - Floor Coverings Nonwoven Material Consumption, Historical and Forecast.....	266
IIIB-31	Home and Office Furnishings - Upholstered Furniture Nonwoven Material Consumption, Historical and Forecast.....	269
IIIB-32	Home and Office Furnishings – Bedding Nonwoven Material Consumption by Category, 2019.....	271
IIIB-33	Home and Office Furnishings – Bedding Nonwoven Material Consumption, Historical and Forecast.....	272
IIIB-34	Home and Office Furnishings - Other Furnishings Nonwoven Material Consumption by Category, 2019.....	274
IIIB-35	Home and Office Furnishings - Other Furnishings Nonwoven Material Consumption, Historical and Forecast.....	277
IIIB-36	Geosynthetics Nonwoven Material Consumption by Category, 2019 .....	279
IIIB-37	Geosynthetics Nonwoven Material Consumption, Historical and Forecast .....	280
IIIB-38	United States Value of Nonresidential Construction Put in Place, Historical and Forecast.....	282
IIIB-39	Geosynthetics – Civil Engineering Nonwoven Material Consumption by Category, 2019 .....	283



IIIB-40	Geosynthetics – Civil Engineering Nonwoven Material Consumption, Historical and Forecast.....	294
IIIB-41	Geosynthetics – Agriculture Nonwoven Material Consumption by Category, 2019 .....	295
IIIB-42	Geosynthetics – Agriculture Nonwoven Material Consumption, Historical and Forecast.....	298
IIIB-43	Apparel Nonwoven Material Consumption, Historical and Forecast .....	305
IIIB-44	Other Disposable Applications Material Consumption, Historical and Forecast.....	310
 <b>IV. North American Nonwoven Supply</b>		
IV-1	Capacity by Process, Tonnes, 2019 .....	311
IV-2	Capacity by Region, Tonnes, 2019 .....	311
IV-3	North American Capacity by Process, Tonnes, 1990–2019, 5-Year Periods .....	313
IV-4	North American Capacity by Process, Tonnes, 2010–2019, Yearly.....	315
IV-5	Capacity by Detailed Process, Tonnes, 2019 .....	316
IV-6	North American Capacity by Detailed Process, Tonnes, 2010–2019.....	318
IV-7	North American Capacity, Production and Operating Rate, Tonnes 2005, 2010, 2015, 2019 .....	322
IV-8	North American Capacity, Production and Operating Rate by Process, Tonnes, 2005, 2010, 2015, 2019 .....	324
IV-9	North American Capacity, Production and Operating Rate, Tonnes, 2013–2019 .....	326
IV-10	North American Capacity, Production and Operating Rate by Process, Tonnes, 2017–2019 .....	328
IV-11	North American Production by End-Use Market 2019, Tonnes.....	329
IV-12	Share of Resin and Staple Fiber Used in North America Production, 2019, Tonnes .....	330
IV-13	Types of Synthetic Polymers Used in North America Production, 2019, Tonnes	331
IV-14	North America Spunlaid Resin Consumption, 2019, Tonnes .....	332
IV-15	North America Staple Fiber Consumption, 2019, Tonnes .....	333
IV-16	U.S. Nonwoven Material Imports and Exports, 1989–2019, Tonnes.....	338

IV-17	U.S. Nonwoven Material Imports and Exports 1996 to 2019, Dollars.....	339
IV-18	United States – Mexico Nonwoven Material Trade, 2009–2019, Tonnes .....	341
IV-19	United States – Mexico Nonwoven Material Trade 2009 to 2019, Dollars .....	342
IV-20	U.S. Nonwoven Roll Material to Mexico by Weight, Tonnes, 2009–2019 .....	343
IV-21	U.S. Nonwoven Material Imports from Mexico by Weight, Tonnes, 2009–2019..	343
IV-22	United States – Canada Nonwoven Material Trade, 2009–2019, Tonnes .....	344
IV-23	United States – Canada Nonwoven Material Trade, 2009–2019, Dollars .....	345
IV-24	U.S. Nonwoven Material Exports to Canada by Weight,2009–2019, Tonnes.....	346
IV-25	U.S. Nonwoven Material Imports from Canada by Weight,2009–2019, Tonnes..	346
IV-26	North American Nonwoven Material Exports by Region Destination, Tonnes, 2009–2019 .....	348
IV-27	North American Nonwoven Material Exports by Detailed Region Destination, Tonnes, 2009-2019.....	349
IV-28	Top 10 Export Countries for North American Nonwoven Material, Tonnes, 2009–2019 .....	351
IV-29	North American Nonwoven Material Imports by Region of Origin, Tonnes, 2009–2019 .....	353
IV-30	North American Nonwoven Material Imports by Detailed Region of Origin, Tonnes, 2009–2019 .....	354
IV-31	Top 10 Import Countries to North America for Nonwoven Material, Tonnes, 2009–2019 .....	356
IV-32	North American Nonwoven Material Imports from China by Weight Category, Tonnes, 2009–2019.....	357
IV-33	2019 North American Nonwoven Material Intra-Region Trade Flow Map.....	358
IV-24	2019 North American Nonwoven Material Trade Flow by Region Map.....	359

## LIST OF TABLES

### II. Economic and Population Drivers

II-1	Annual Growth of Real GDP in North America by Country, Historical and Forecast.....	14
II-2	Annual Growth of Real GDP Comparison from Previous Report Forecast to Actual GDP .....	15

### III. North American Nonwoven Demand

III-1	North American Nonwoven Market Nonwoven Material Consumption by Disposable and Durable, Historical and Forecast .....	28
-------	---	----

#### IIIA. Disposable Applications Demand

IIIA-1	North American Disposable Nonwoven Markets Sales and Units by End-Use, Historical and Forecast.....	35
IIIA-2	North American Disposable Nonwoven Markets Nonwoven Material Consumption by End-Use, Historical and Forecast .....	39
IIIA-3	North American Absorbent Hygiene Market Sales and Units by Category, Historical and Forecast.....	44
IIIA-4	North American Absorbent Hygiene Market Nonwoven Material Consumption by Category, Historical and Forecast.....	45
IIIA-5	Diaper Changes per Day by Age by Region, Historical and Forecast .....	52
IIIA-6	North American Disposable Diaper and Training Pants Market Profile Annual Growth Rates, Historical and Forecast.....	53
IIIA-7	Absorbent Hygiene Diaper and Training Pant Market Sales and Units by Category, Historical and Forecast.....	54
IIIA-8	North American Diaper and Training Pant Market Nonwoven Material Consumption by Category, Historical and Forecast.....	55
IIIA-9	Absorbent Hygiene Consumer Incontinence Market Sales and Units by Category, Historical and Forecast.....	62
IIIA-10	North American Consumer Incontinence Market Nonwoven Material Consumption by Category, Historical and Forecast.....	64
IIIA-11	Absorbent Hygiene Consumer Feminine care Market Sales and Units by Category, Historical and Forecast.....	67

IIIA-12	North American Consumer Feminine care Market Nonwoven Material Consumption by Category, Historical and Forecast.....	69
IIIA-13	Institutional Absorbent Hygiene Market Sales and Units by Category, Historical and Forecast.....	72
IIIA-14	North American Institutional Hygiene Market Nonwoven Material Consumption by Category, Historical and Forecast.....	74
IIIA-15	North American Filtration Market Sales by Segment, Historical and Forecast.....	79
IIIA-16	North American Filtration Market Nonwoven Material Consumption by Segment, Historical and Forecast .....	81
IIIA-17	North American Air Filtration Market Sales and Units by Category, Historical and Forecast.....	84
IIIA-18	North American Air Filtration Market Nonwoven Material Consumption by Category, Historical and Forecast.....	86
IIIA-19	North American Industrial Air Filtration Market Sales and Units, Historical and Forecast.....	89
IIIA-20	North American Industrial Air Filtration Market Nonwoven Material Consumption, Historical and Forecast.....	91
IIIA-21	Number of North American Vehicles by Region, Historical and Forecast.....	93
IIIA-22	North American Transportation Air Filtration Market Sales and Units by Category, Historical and Forecast.....	95
IIIA-23	North American Transportation Air Filtration Market Nonwoven Material Consumption by Category, Historical and Forecast.....	95
IIIA-24	North American Commercial Air Systems Filtration Market Sales and Units by Category, Historical and Forecast.....	98
IIIA-25	North American Commercial Air Systems Filtration Market Nonwoven Material Consumption by Category, Historical and Forecast.....	99
IIIA-26	Number of North American Housing Units, Historical and Forecast.....	101
IIIA-27	North American Residential Locations Air Filtration Market Sales and Units by Category, Historical and Forecast.....	102
IIIA-28	North American Residential Locations Air Filtration Market Nonwoven Material Consumption by Category, Historical and Forecast.....	103
IIIA-29	North American Personal Protection Air Filtration Market Sales and Units by Category, Historical and Forecast.....	105

IIIA-30	North American Personal Protection Air Filtration Market Nonwoven Material Consumption by Category, Historical and Forecast.....	107
IIIA-31	North American Vacuum Cleaner Air Filtration Market Sales and Units, Historical and Forecast.....	108
IIIA-32	North American Vacuum Cleaner Air Filtration Market Nonwoven Material Consumption, Historical and Forecast.....	109
IIIA-33	North American Liquid Filtration Market Sales .....	111
IIIA-34	North American Liquid Filtration Market Nonwoven Material Consumption by Category, Historical and Forecast.....	113
IIIA-35	North American Wipes Market Sales and Units by Segment, Historical and Forecast.....	122
IIIA-36	North American Wipes Market Nonwoven Material Consumption by Segment, Historical and Forecast .....	125
IIIA-37	North American Consumer Wipes Market Sales and Units by Category, Historical and Forecast.....	127
IIIA-38	North American Consumer Wipes Market Nonwoven Material Consumption by Category, Historical and Forecast.....	129
IIIA-39	North American Baby Wipes Market Sales and Units by Category, Historical and Forecast.....	131
IIIA-40	North American Baby Wipes Market Nonwoven Material Consumption by Category, Historical and Forecast.....	133
IIIA-41	North American Home Care Wipes Market Sales and Units by Category, Historical and Forecast.....	134
IIIA-42	North American Home Care Wipes Market Nonwoven Material Consumption by Category, Historical and Forecast.....	136
IIIA-43	North American Personal Care Wipes Market Sales and Units by Category, Historical and Forecast.....	141
IIIA-44	North American Personal Care Wipes Market Nonwoven Material Consumption by Category, Historical and Forecast.....	143
IIIA-45	North American Industrial/Institutional Wipes Market Sales and Units by Segment, Historical and Forecast.....	149
IIIA-46	North American Industrial/Institutional Wipes Market Nonwoven Material Consumption by Segment, Historical and Forecast .....	151
IIIA-47	North American Specialty Industrial Wipes Market Sales and Units by Category, Historical and Forecast.....	156

IIIA-48	North American Specialty Industrial Wipes Market Nonwoven Material Consumption by Category, Historical and Forecast.....	158
IIIA-49	North American Institutional Healthcare/Medical Wipes Market Sales and Units by Category, Historical and Forecast.....	163
IIIA-50	North American Institutional Healthcare/Medical Wipes Market Nonwoven Material Consumption by Category, Historical and Forecast.....	166
IIIA-51	North American Healthcare Facility Usage by Process, Historical and Forecast.....	172
IIIA-52	North American Disposable Medical/Surgical Market Sales and Units by Category, Historical and Forecast.....	176
IIIA-53	North American Disposable Medical/Surgical Market Nonwoven Material Consumption by Category, Historical and Forecast.....	177
IIIA-54	North American Surgical Packs and Gowns Market Sales and Units, Historical and Forecast.....	179
IIIA-55	North American Surgical Packs and Gowns Market Nonwoven Material Consumption, Historical and Forecast.....	181
IIIA-56	North American Medical and Surgical Other Apparel Market Sales and Units, Historical and Forecast.....	181
IIIA-57	North American Medical and Surgical Other Apparel Market Nonwoven Material Consumption, Historical and Forecast.....	182
IIIA-58	North American Medical/Surgical Sterile Packaging and Sterilization Wrap Market Sales and Units, Historical and Forecast.....	183
IIIA-59	North American Medical/Surgical Sterile Packaging and Sterilization Wrap Market Nonwoven Material Consumption, Historical and Forecast.....	184
IIIA-60	North American Medical and Surgical Wound Care Market Sales and Units, Historical and Forecast.....	186
IIIA-61	North American Medical and Surgical Wound Care Market Nonwoven Material Consumption, Historical and Forecast.....	187
IIIA-62	North American Other Disposable Applications Market Sales and Units by Category, Historical and Forecast.....	189
IIIA-63	North American Other Disposable Applications Market Nonwoven Material Consumption by Category, Historical and Forecast.....	196

**IIIB. Durable Applications Demand**

IIIB-1	North American Durable Nonwoven Markets Nonwoven Material Consumption by End-Use, Historical and Forecast.....	198
IIIB-2	North American Transportation Market Nonwoven Material Consumption by Segment, Historical and Forecast.....	208
IIIB-3	North American Light Vehicle Market Nonwoven Material Consumption by Category, Historical and Forecast.....	224
IIIB-4	North American Other Transportation Market Nonwoven Material Consumption, Historical and Forecast.....	227
IIIB-5	North American Building Construction Market Nonwoven Material Consumption by Category, Historical and Forecast.....	245
IIIB-6	North American Building Construction – Roofing Market Nonwoven Material Consumption by Category, Historical and Forecast.....	247
IIIB-7	North American Building Construction – Underlayment Market Nonwoven Material Consumption, Historical and Forecast.....	251
IIIB-8	North American Building Construction – Other Materials Market Nonwoven Material Consumption, Historical and Forecast.....	254
IIIB-9	North American Home and Office Furnishings Market Nonwoven Material Consumption by Category, Historical and Forecast.....	259
IIIB-10	North American Home and Office Furnishings – Floor Coverings Market Nonwoven Material Consumption by Category, Historical and Forecast.....	265
IIIB-11	North American Home and Office Furnishings – Upholstered Furniture Market Nonwoven Material Consumption, Historical and Forecast.....	267
IIIB-12	North American Mattress and Foundation Consumption, Units, Historical and Forecast.....	270
IIIB-13	North American Home and Office Furnishings – Bedding Market Nonwoven Material Consumption by Category, Historical and Forecast.....	273
IIIB-14	North American Home and Office Furnishings – Other Furnishings Market Nonwoven Material Consumption by Category, Historical and Forecast.....	276
IIIB-15	North American Geosynthetic Market Nonwoven Material Consumption by Segment, Historical and Forecast.....	280
IIIB-16	North American Geosynthetic – Civil Engineering Market Nonwoven Material Consumption by Category, Historical and Forecast.....	293

IIIB-17	North American Geosynthetic – Agriculture Market Nonwoven Material Consumption by Category, Historical and Forecast.....	296
IIIB-18	North American Apparel Market Nonwoven Material Consumption, Historical and Forecast .....	304
IIIB-19	North American Other Durables Market Nonwoven Material Consumption, Historical and Forecast .....	307
 <b>IV. North American Nonwoven Supply</b>		
IV-1	North American Capacity Annual Growth Rates by Process, 1990–2019, 5-Year Periods .....	314
IV-2	North American Capacity Annual Growth Rates by Process, 2011–2019.....	317
IV-3	North American Drylaid Capacity Annual Growth Rates, 2011–2019.....	319
IV-4	North American Spunlaid Capacity Annual Growth Rates, 2011–2019.....	319
IV-5	North American Annual Net Capacity Additions by Line Type, 2015–2019.....	320
IV-6	North American Capacity, Production, and U.S. GDP Growth Rates, Five-Year Periods, 2005–2019.....	321
IV-7	North American Production Annual Growth Rates by Process, Five-Year Periods, 2005–2019.....	323
IV-8	North American Capacity, Production, and U.S. GDP Growth Rates, 2013–2019 .....	325
IV-9	North American Capacity and Production Growth Rates by Process, 2019 .....	327
IV-10	Top 10 Countries for North American Exports Yearly Comparison, 2009, 2018, 2019 .....	350
IV-11	Top 10 Countries Importing to North America Yearly Comparison, 2009, 2018, 2019 .....	355



## VI. Appendix

INDA has undertaken this study to fulfill the element of its mission to **provide credible statistics to its members and the overall industry**. While no study is perfect, INDA has devoted considerable time, knowledge, reach, and resources to make this the most accurate and **most comprehensive analysis** of the total North American nonwovens industry. INDA has no pretenses that this report accounts for all of the material in North America, for it would be nearly impossible in one report. Instead this report provides the most comprehensive view of the North American nonwovens industry. This report presents the detailed demand and supply data for the North American nonwovens industry for 2014 and 2019, and a forecast for 2024. This information is intended to assist those in the nonwoven industry in making better business decisions.

### A. Methodology

---

This information is provided in good faith by INDA, and while we endeavor to keep the information up to date and correct, we make no representation or warranties of any kind, express or implied, about the completeness, accuracy, reliability, suitability, or availability with respect to the information, figures, or related graphics contained within this document.

Any reliance the user places on such information is therefore strictly at the user's own risk. In no event will INDA be liable for any loss or damage whatsoever, including indirect or consequential, arising from the loss of data or profits arising out of or in connection with the use of this information.

The time periods in the report refer to the final day of each of the years stated. For example, 2014–2019 is five years of data, as it refers to December 31, 2014 to December 31, 2019. The forecast period referenced was changed in this report to avoid confusion of 2019 appearing in both the historical and forecast dates. The forecast period, 2020–2024 is also five years of data, as it refers to January 1, 2020 to December 31, 2024.

### I. Demand Model

---

The North American Nonwovens Industry Outlook report utilizes numerous methods in the building of the demand model. The model is built up at the individual category level—**262 categories**—within each of the **11 end use markets** to arrive at a total North American demand.

Demand is defined as the North American—United States, Canada, and Mexico—consumption or use of an item that contains the nonwoven material. For example, demand for baby diapers is based upon the use of baby diapers in North America and

the average amount of nonwoven material used to produce each of those baby diapers. Another example is in vehicle construction. The vehicle nonwoven demand measures the estimated amount of nonwoven material used in each vehicle that is purchased in North America.

The demand model, therefore, is an estimated measure of the total possible use of nonwoven material for items containing nonwovens that are consumed or used in North America. It is not a measure of the nonwoven material produced in North America to make the product that is produced in North America. All of the end-use categories, to some degree, have a portion of the product imported from overseas, which is accounted for in the demand model.

The demand model is based upon primary research, secondary research, and economic data. Extensive interviews were done with a wide range of industry participants—suppliers, producers, converters, brand owners, and industry participants—in the various markets to aid in establishing market sizes, growth rates and trends.

In addition to using information attained from INDA's internal database, the model is supplemented by secondary research obtained through constant tracking of industry data through press releases, annual company reports, industry publications, trade/industrial associations, and national statistics bureaus.

The demand model makes use of economic data and INDA forecasts for:

- ▶ U.S. gross domestic product (GDP);
- ▶ U.S. personal consumption expenditures (PCE);
- ▶ U.S. furniture PCE;
- ▶ U.S. carpets and other floor coverings PCE;
- ▶ U.S. window coverings PCE;
- ▶ U.S. private domestic nonresidential equipment expenditures;
- ▶ U.S. federal government nondefense consumption expenditures;
- ▶ U.S. Census manufacturers' shipments furniture and related products;
- ▶ U.S. Census value of shipments of upholstered household furniture;
- ▶ Bureau of Labor Statistics (BLS) average annual expenditures of furniture;
- ▶ BLS average annual expenditures of floor coverings;
- ▶ BLS average annual expenditures of household textiles;
- ▶ State and local governments consumption expenditures;
- ▶ U.S. International Trade Commission trade data;
- ▶ Canadian GDP;

- ▶ Mexican GDP; and
- ▶ Number of households.

The demand model also utilizes population data and U.S. Census, World Bank and INDA forecasts in the United States, Canada, and Mexico for:

- ▶ Births;
- ▶ Women between the ages of 13 through 51;
- ▶ Elderly (65+); and
- ▶ Those with incontinence issues.

The demand model makes use of further inputs of industry data and INDA forecasts for:

- ▶ Manufacturer shipments of central air conditioners and heat pumps;
- ▶ Medical facilities;
- ▶ Medical admissions and procedures;
- ▶ Emergency department visits related to injury, poisoning, and adverse effect;
- ▶ New residential building starts;
- ▶ New single-family home sales;
- ▶ Existing-home sales;
- ▶ Repair and remodel expenditures;
- ▶ Private nonresidential construction;
- ▶ Public nonresidential construction;
- ▶ Mattress and foundation sales;
- ▶ Upholstered furniture sales;
- ▶ Upholstered furniture factory shipments;
- ▶ Floor covering market sales for carpet and rugs;
- ▶ Vehicles in-use;
- ▶ Passenger car, light truck and heavy truck production;
- ▶ Passenger car, light truck and heavy truck sales;
- ▶ Civilian aircraft shipments;
- ▶ Powerboats and sailboat retail sales;
- ▶ Transit car deliveries; and
- ▶ Automotive battery purchases.

These historical data and forecasts, in addition to data acquired through the primary and secondary interviews, feed into the demand model to derive the nonwoven material demand for North America. The model output is further augmented by applying any driving forces that may impact an end-use; driving forces, such as social and cultural changes, innovations, new products and services, government regulations and policy, changes in buyers' attitudes, and technology.

When comparing the data, please note there is not a direct one-to-one correlation between the 2019 North American Nonwovens Industry Outlook report and previous INDA reports. In this report, INDA has been more inclusive of nonwoven materials, including some nonwoven material that was not included in the past. Additionally, the previous INDA reports did not include Mexico, which has been included in this edition of the report.

## 2. Supply Model

---

The supply model is based upon industry surveys (conducted for 2012 through 2020) and discussions with both INDA members and nonmembers. In order to provide comparable and representative data for the entire North American industry, estimates are made for the non-responding companies. Historical data is based upon surveys conducted in the 1990s and previously published INDA reports, specifically the North American Nonwovens Industry Outlook and the Worldwide Outlook for the Nonwovens Industry.

Whenever new figures are added for a specific year from a company that had already produced nonwovens in the previous years, corrections are made to the figures of the previous year(s), which may result in slightly different numbers in comparing previous reports.

Capacity is based upon a lines nameplate capacity that is the intended technical full-load sustained output of a line. Actual annual capacity of any line, once in production, could be lower depending upon product mix, number of shifts, and maintenance requirements. For example, a spunbond machine may have a capacity of 24,000 tonnes per year at 14 gsm (grams per square meter). If that machine were to change to producing 12 gsm with the same throughput, the *operating rate* would drop even though the machine may be operating at full throughput capacity.

Production numbers not only include sales in the North American market or for export, but also any that may have been manufactured for the producing company's own use.

Weight is expressed in metric tonnes. The weight of nonwovens relates to the finished products of the web production line, typically a roll but not necessarily, including added adhesives, additives, and other chemicals, excluding wrapping materials.

---

## B. Nonwoven Material Definitions

---

Following are definitions of terms used throughout the report. The nonwoven definition is now based upon the new International Organization for Standardization (ISO) definition, ISO 9092:2019 (E).

### 1. Nonwoven Definition

---

**Nonwoven:** An engineered fibrous assembly, primarily planar, which has been given a designed level of structural integrity by physical and/or chemical means, excluding weaving, knitting or papermaking.

**Fibrous Assembly:** A predetermined amount and arrangement of natural or manufactured fibrous material such as, but not limited to fibres, continuous filaments, or chopped yarns of any length or cross-section. It can be a two- or three-dimensional alignment of fibrous materials made by a web-forming process.

**Engineered:** An application of science to design, plan, and manufacture products to utility specifications.

**Structural Integrity:** A measureable level of added tensile strength.

**Physical and/or Chemical Means:** A specific bonding technology that results in frictional forces between fibres (through entanglement) or adhesive forces between fibres (with or without the use of binders).

### 2. Forming Processes

---

The primary criterion used for categorizing nonwoven capacity and production is by the forming process. The nonwoven material forming process can be categorized into four distinct categories:

- ▶ Drylaid
- ▶ Spunlaid
- ▶ Wetlaid
- ▶ Airlaid Short Fiber

#### Drylaid

The drylaid web-forming process refers to dry staple fiber-based nonwoven webs, produced using either a mechanical web formation of carding/garneting or the aerodynamic web formation of airforming equipment, such as the Rando Webber machine. Carding equipment separates the fibers from each other impurities, aligns and delivers the fibers to the lay-down device where they are laid down as a web. The

drylaid web is then thermally, chemically, or mechanically (needlepunch, hydroentanglement, or stitch-bond) bonded.

The drylaid processes are further defined in the report by the bonding processes below:

**Needlepunch/Stitchbond:** Needlepunch and stitchbond are separate bonding processes, but are combined into one category for reporting, due to the smaller size of the stitchbond category.

**Needlepunch:** Needlepunch mechanical binds a web to form a fabric by penetrating the web with an array of barbed needles that carry tufts of the web's own fibers in a vertical direction through the web.

**Stitchbond:** A bonding technique in which fibers in a web are bonded together by stitches sewn or knitted through the web to form a fabric. The finished fabric sometimes resembles corduroy.

**Hydroentangle:** Hydroentanglement is a method of bonding fibers, not a web-forming process. The hydroentanglement technology is a system in which water is emitted under high pressures and velocity from closely positioned nozzles onto a web of loose fibers. The intensity of the water stream and the pattern of the supporting drum or belt entangle, spin, and curl the fibers about one another. The entangling of the fibers and friction between the fibers yields a cohesive web.

Hydroentanglement is also known by several other names, including spunlace and spunlacing. INDA prefers to use the term hydroentanglement rather than spunlacing as there is potential for people unfamiliar with the industry to confuse spunlacing with spunlaid, spunmelt, and spunbond.

**Thermal/Chemical:** Thermal and chemical are separate bonding process but are combined into one category for reporting, due to the smaller size of these processes.

**Thermal:** Thermal bonding is a technique for bonding a web of fibers in which a heat or ultrasonic treatment, with or without pressure, is used to activate a heat-sensitive material. The material may be in the form of homofil fibers, bicomponent fibers, or fusible powders, as part of the web. The bonding may be applied all over (e.g., through or area bonding) or restricted to predetermined, discrete sites (e.g., point bonding).

**Chemical:** Chemical bonding, also known as resin bonding, is a method of bonding fibers by using chemical agents, which may include adhesive resins and solvents. Most common is resin bonding. Latex resins (adhesive) are applied to the web by a variety of methods: dipping the web into the latex and removing the excess, spraying, foaming, or printing bonding. The resin is usually in a water-based solution, so this bonding process requires heat to remove the water to dry and set the binder into the fabric. This is sometimes referred to as latex bonding.

## Spunlaid

The spunlaid process, also referred to as spunlaid, refers to spunlaid polymer-based nonwoven webs, including composites (e.g., SM, SMS, SMMS, etc.), meltblown, flashspun, and other types of nonwovens originating from polymers. Spunlaid is a web-forming process in which the production line extrudes and supplies its own fibers from a molten polymer in one continuous process. The most common polymers used are polypropylene, polyester and polyethylene.

Within the report the spunlaid processes are further defined by the web forming processes below:

**Spunbond/Spunmelt:** Included with this category for reporting purposes are both spunbond and spunbond/meltblown composites.

**Spunbond:** A spunlaid technology in which the filaments have been extruded, drawn and laid on a moving screen to form a web. The term is often interchanged with spunlaid, but the industry has conventionally adopted the spunbond or spunbonded term to denote a specific web forming process. This is to differentiate this web-forming process from the other two primary forms of spunlaid web forming, which are meltblown and flashspun.

**Spunmelt:** A multiple layer fabric that is generally made of various alternating layers of spunbond and meltblown webs, referred to as SMS, SMMS, SSMMS, etc.

**Meltblown:** A one-step nonwoven web-forming process in which hot high-velocity air draws a molten thermoplastic resin extrude from a small orifice onto a conveyor or take-up screen to form a fine fibered self-bonded web. The meltblown process is similar to the spunbond process in that thermoplastic polymers are extruded through a spinning die, to form filaments. The principle difference is that the meltblown process produces a web composed of finer filaments and are generally measured in microns. Much of the difference is due to the way the air streams converge around the fiber as it exits the spinneret and accelerates the extrudate. The meltblown process uses large amounts of high-temperature air that is typically as high or higher than the temperature of the polymer.

### Other Spunlaid Processes:

**Flashspun:** A modified spunlaid technology in which a polymer/solvent solution is extruded under conditions in which rapid solvent evaporation at the spinneret occurs so that the individual filaments are disrupted into a highly fibrillar form and are collected on a moving screen to form a web.

**Coform:** A nonwoven web-forming process comprising a matrix of meltblown fibers and at least one additional material, often called the secondary material. Examples of the second material include absorbent fibrous organic materials such as wood and non-wood pulp from, for example, cotton, rayon, recycled



paper, or fluff pulp; superabsorbent materials such as superabsorbent particles and fibers; inorganic absorbent materials and treated polymeric staple fibers; and other materials such as non-absorbent staple fibers and non-absorbent particles and the like. The most notable of the coform structures were developed by Kimberly-Clark (K-C) involving wood pulp fibers and 3M's Thinsulate with blend of polypropylene or polyester staple fiber.

## Wetlaid

Wetlaid nonwovens are produced through a process similar to paper making. The nonwoven web is produced by filtering an aqueous suspension of fiber onto a screen conveyor belt or perforated drum. Many wetlaid nonwovens are made with wood pulp or other natural fibers blended with synthetic fibers or glass.

In a wetlaid process in which cellulose or other fibers are engineered to a level of structural integrity by physical and/or chemical means other than hydrogen bonding, the assembly can be considered to be a nonwoven.

Paper is traditionally regarded as a thin material produced by pressing moist, refined cellulose fibers together and drying them to create a hydrogen-bonded sheet. The fibers in paper are typically short and wetlaid from a water suspension. When rewet, the hydrogen bonds between fibers are broken, and paper typically loses almost all of its strength. In some papers, to achieve wet strength, a polymeric binder (referred to as wet strength resin) is added to the structure. The refined fibers, plus the self-bonding that occurs between cellulose fibers during drying, distinguish paper from nonwovens.

## Airlaid Short Fiber

The airlaid short fiber process, originally conceived as a way to make paper without water, refers to a way of laying shortcut staple fibers, typical of a Kroyer/M&J or Dan-Web line, dispersed by air through a forming head to form a continuous web. Although the principal fiber used to produce airlaid nonwovens is fluff pulp, other natural and synthetic, and mineral fibers, primarily glass and metal fibers, are also used. Airlaid nonwoven technology generally uses latex emulsions, thermoplastic fibers, or some combination of both to bond the web's fibers and increase the strength and integrity of the sheet.



## C. Nonwoven End Use Classifications and Definitions

---

Following are end use classifications used in the report. At the basic level, the markets can be defined as disposable markets and durable markets.

### I. Disposables

---

A product designed to be replaced, comprised of 5 end use markets comprised of 133 demand-model categories.

#### **Absorbent Hygiene** (16)

- 1) Consumer Absorbent Hygiene (12)
  - Baby Diapers and Training Pants
  - Incontinence Products (Underwear-Pull-Ups, Briefs-Diaper Style, Underpads, Pads/Shields, Liners)
  - Feminine Care (Sanitary Napkins/Pads, Panty Liners, Tampons)
  - Pet Products (Diapers, Underpads)
- 2) Institutional Absorbent Hygiene (4)
  - Incontinence Products (Briefs, Underwear, Underpads)
  - Baby Diapers

#### **Filtration** (51)

- 1) Air Filtration (29)
  - Industrial/Manufacturing
    - Dust Collection Systems: Low and High Temperate Baghouse
    - Turbine Air Intake: Pre-Filter, Cartridge, Panel/Pocket Filter/V-Cell
    - Industrial Pollution Control, including Exhaust and Flue Gas
  - Transportation
    - Induction/Air Intake: Light-Duty, Medium-Duty, Truck/Heavy-Duty (2 Types)
    - Cabin Air: Standard Cabin Air, Combi Cabin Air and HEPA (Both Light Vehicle and Heavy Vehicle)
  - Commercial Air Systems (High Efficiency: HEPA and ULPA, including Medical and Industrial Controlled Environments; Mid-Range Efficiency: MERV 9-15; Low Efficiency: MERV 1-8, Flat Panel and Pleated)
  - Residential Locations (HVAC/Furnace Basic, HVAC/Furnace Enhanced/Pleated, HEPA/ULPA Air Purifiers)
  - Personal Protection/Face Masks (Pleated Consumer, Pleated Medical/Dental/Commercial, Respirator Consumer, Respirator Medical/Industrial)
  - Vacuum Cleaner Bags (Standard, Standard w/Meltblown Liner, HEPA w/Meltblown Liner)
- 2) Liquid Filtration (22)
  - Transportation - Oil/Lubrication/Fuel/Transmission Fluids
  - Industrial /Manufacturing
    - High Technology: High Purity Chemicals, Ultrapure Water, Solvent, Chemical Mechanical Polish Slurry

- Hydraulics: Heavy Equipment and Machinery
- Hydrocarbon Processing: Well Injection Water, Produced Water, Amine Filtration
- Industrial Processes: Chemicals, Metal Working Coolants, Water Jets, Paints & Coatings, Pre-Polymers, Inks, Cosmetics
- Water
  - Industrial Processes: Cooling Towers, Process Water, Boiler Feed Water
  - Swimming Pool/Spa
  - Municipal Water/Wastewater: Municipal Drinking Water; Water/Desalinization Plants; Wastewater
  - Consumer/Commercial Water: Point of Use/Point of Entry
- Food and Beverage Processing
  - Bottled Beverages (Beer, Wine, Other Beverages)
  - Coffee Filters, including Pods
  - Cooking Oil
  - Milk
  - Tea Bags
  - Other Aqueous Foods/Beverages
- Healthcare
  - Biotechnology/ Pharmaceuticals
  - Medical Devices, including Blood

## **Wipes (33)**

### 1) Consumer Wipes (19)

- Baby (Standard, Premium)
- Home Care (Disinfecting, General-Purpose/Surface Cleaning, Wet Floor Cleaning, Electrostatic Dry Floor Cleaning, Automotive Aftercare, Glass/Screen Cleaning, Furniture Polishing, Metal/Stainless Cleaning, Dry Cleaning Towel and Other Dry Home Care Wipes)
- Personal Care (Moist Toilet Tissue, Toddler Training, Cosmetic/Facial Cleaners, General Body including Pet Care, Antibacterial/ Hand Sanitizer, Intimate/Feminine Care, Adult Incontinence/Bath, Facial Sheet Masks, Other Impregnated (e.g., bug repellent, medicinal))

### 2) Industrial and Institutional Wipes (14+19)

- Industrial/Commercial – General-Purpose/Manufacturing/Janitorial (3 Process Types)
- Industrial – Specialty (Cleanroom Electronic, Cleanroom Pharmaceutical/Food, Printing/Photography Industry, Surface Prep for Auto/Aerospace Industry)
- Institutional – Food Service and Hospitality
- Institutional – Healthcare and Medical (Disinfecting, Incontinence, Patient Bathing/Wash Cloth, Antibacterial/ Hand Sanitizer, Alcohol Prep Pads/Iodine/Antiseptic/Other)

## **Medical/Surgical (16)**

### 1) Surgical Packs and Surgical Gowns

- Surgical Packs (Pack Gowns, Drapes, Back Table Covers, Mayo/Instrument Stand, Pack Stand, Other Parts)
- Individual Surgical Gowns

- 2) Other Apparel (Scrub Suits, Isolation Gowns, Patient Apparel, Bouffant & Surgical Caps, Shoe Covers, Bedding)
- 3) Sterile Packaging/Sterilization Wrap
- 4) Wound Care
  - Non-Implantables (Surgical Gauze including Pads, Sponges, Undercast Padding & Wound Packing; Surgical Tapes; Wound Dressings, primarily Non-Adherent Dressings)
  - Implantables

### **Other Disposable Applications (17)**

- 1) Bedding (Pillowcases, Sheets, Headrest Covers)
- 2) Dryer and Dye Scavenger Sheets
- 3) Envelopes
- 4) Oil/Chemical Sorbents—Industrial and Spill Response (Mats/Pads, Rolls, Socks, Oil Sorbent Booms & Sweeps)
- 5) Packaging Materials (e.g., Absorbent Food Pads, Bale Wrap, Can Separators, Cargo Covers, Thermal Insulation)
- 6) Personal Protective Equipment
  - Emergency Response, Chemical/Biological Hazards Apparel
  - Agriculture, Paint, Food Processing Apparel
  - Cleanroom/Laboratory Apparel
- 7) Cleaning/Scrub/Scouring and Abrasive/Polishing Discs/Pads
- 8) Tabletop (Napkins, Table Covers, Cutlery Wraps, Basket Liners)
- 9) Tape Substrate
- 10) Other Disposables

## 2. Durables

---

A product designed to have an average useful life of at least 3 years (based on the economic definition of Durable Goods) comprised of 6 end use markets comprised of 129 demand-model categories.

### **Vehicle Construction** (not including filtration media) (51)

(22 Passenger Vehicle Components, 20 Light Trucks, 9 Other Transportation Modes)

#### Vehicle Sectors

- 1) Automotive
  - Passenger Vehicles
  - Light Trucks/SUVs/Vans/Crossovers
- 2) Other Transportation Modes
  - Heavy Trucks/Commercial Freight Vehicles, Motor Buses, RVs
  - Air (General Aviation, Commercial Transport Aircraft, Helicopters)
  - Rail (Intercity Passenger/Passenger Train Car, Light Rail, Streetcars/Trolleys)
  - Water (Powerboats, Sailboats, Including Tarps)

#### Nonwoven Components

- 1) Exterior
  - Firewall/Heat Shield Insulation
  - Firewall/Heat Shield Veil
  - Hood Liner/Insulator
  - Outer Dash Panel Insulation
  - Underbody Systems/Shield
  - Wheelhouse Liners
  - Other Exterior Components (e.g., Engine Encapsulations, Adhesive Tape Cable Sheaths, Tunnel Insulation Parts, Muffler Wraps, Battery Covers, Tarpaulins)
- 2) Interior
  - Console Components/Trim
  - Dash Package Shelf/Tray
  - Door/Kick Panels
  - Floor Carpeting/Mats
  - Floor Insulation
  - Headliner
  - Primary and Secondary Carpet Backing
  - Rear Package Shelf/Tray
  - Seat Components
  - Seat Trim
  - Side Pillar Trim
  - Trunk/Tailgate Liner
  - Trunk/Tailgate Trim
  - Other Interior Components (e.g., HVAC Ducting)

**Building Construction** (16)

- 1) Roofing Materials
  - Residential (Steep Slope Roof Materials) (2 Process Types)
  - Nonresidential (Low Slope/Flat Roof Materials) (4 Process Types)
- 2) Underlayment
  - Building Wrap
  - Roof Underlayment
  - Other Underlayment
- 3) Insulation Boards/Panels
- 4) Product Facing Materials
- 5) Other Building Construction Products

**Home & Office Furnishings** (36)

- 1) Floor Coverings (7)
  - Woven and Tufted Carpet Backing (4 Process Types)
  - Underpads/Underlay and Floor Protectors
  - Entrance/Walk-Off Mats
- 2) Bedding (17)
  - Mattress and Foundation Components (11)
  - Bed Coverings (Bedsread Quilt Backing, Blankets, Crib Mattresses, Dust Ruffle Decking, Mattress Pads Filler, Mattress Pads Topper, Nonwoven Blankets, including Moving and Emergency/Relief Blankets)
- 3) Upholstered Furnishings (8)
  - Components (Cushion Casings, Decking, Dust Covers, Skirt Linings, Spring Insulators, Toss Pillow Casings)
  - Batting/Highloft
- 4) Other Furnishings (4)
  - Window Treatments (Shades/Blinds, Drapery Buckram)
  - Wall Coverings/Wallpaper
  - Other (e.g., Ironing Board Pads, Acoustical Applications, Appliance Acoustical Insulation)

**Geosynthetics** (9)

- 1) Civil/Environmental Engineering
  - Geotextiles for Road Applications (2 Process Types)
  - Geotextiles for Other Applications (Geosynthetic Clay Liners, Geomembranes, Drainage Tubes)
  - Cured-in-Place Pipe
- 2) Agriculture
  - Agricultural Crop Covers/Shading
  - Landscape Fabrics
  - Root Bags

**Apparel** (7)

- 1) Thermal Insulation
- 2) Artificial Leather-Like Goods (e.g., Purses, Wallets)
- 3) Interlinings/Interfacings
- 4) Personal Protective Apparel
  - Military, Police
  - Fire, Chemical, Biohazard
- 5) Shoe Materials (e.g. Upper, Counterliner, Liner, Vamp Liner, Interliner, Reinforcement, Insoles)

**Other Durable Applications** (10)

- 1) Durable Graphic Papers (Art, Maps, Book Covers)
- 2) Electronic
  - Battery (Lead) Separators
  - Battery (Other) Separators
  - Cable Insulation/Wrap
- 3) Fabric Graphics (Banners, Signage)
- 4) Fabric Structures
- 5) Paper Making Felts
- 6) Tote/Promotional Bags
- 7) Felts (Industrial, Craft/Decorative, Equestrian Saddle Padding, Erasers, etc.)
- 8) Other Durables (including Composite Structures not classified elsewhere, such as Nonwoven Glass Prepreg)