



**CHEMISTRY  
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REPORT

# Chemistry and Single-Family Housing

Supporting Comfort,  
Performance and  
Energy Efficiency












## Executive Summary

Chemistry plays a vital role in modern homebuilding, enabling the construction of energy-efficient, comfortable, and durable structures. Single-family housing is a major end-use market for the U.S. chemical industry.

Chemistry is used in various building materials and applications throughout the home, from the basement to the attic. Key areas include:

- **Insulation:** Polystyrene, polyurethane foam, and fiberglass insulation provide thermal resistance, improving energy efficiency and indoor comfort.
- **Building Envelope:** Air and vapor barriers made from polyethylene and polypropylene create a tight building envelope, resisting moisture and air leakage for durability and energy performance.
- **Roofing:** Asphalt shingles, synthetic rubber membranes, and thermoplastic membranes provide waterproofing, UV resistance, and durability.
- **Flooring:** Vinyl, laminate, engineered wood, and carpet offer durability, water resistance, and aesthetics.
- **Siding:** Vinyl and engineered wood siding provide weather resistance, low maintenance, and curb appeal.
- **Kitchen and Bathroom Fixtures:** Materials like laminate, solid surface acrylic, and engineered stone offer durability, stain resistance, and design flexibility.
- **Pipe and Plumbing Fixtures:** PVC, CPVC, and polyethylene provide lightweight, corrosion-resistant, and easy-to-install plumbing systems.
- **Adhesives, Binders & Sealants:** This diverse portfolio includes materials that bond, seal, and finish various building components, enhancing performance, longevity, and reducing energy losses.



Nearly 30.1 billion pounds of chemistry products were used in the building products for over 900,000 single-family homes in the United States in 2023, averaging 33,100 pounds per home.


Plastics and elastomers contribute to the sustainability, comfort, and affordability of homes. An average single-family home contains approximately 6,200 pounds of plastics and 5,400 pounds of elastomers, which provide weather barriers and insulation for energy savings.

Single-family housing represents a crucial market for the U.S. chemical industry, utilizing over 30.1 billion pounds of chemistry materials in 2023.

The U.S. chemical industry remains committed to developing new and innovative materials to help make homes more resilient, sustainable and energy efficient.

## Introduction

The building of modern, comfortable, energy-efficient housing would not be possible today without chemistry materials. Think back to a centuries-old historic home you may have visited. It was likely dark, damp, drafty and lacking in modern conveniences like indoor plumbing and electricity. Over the last century, key innovations in chemistry have enabled new building materials that enable energy efficient insulation to maintain comfortable indoor temperatures and building envelopes to help keep out moisture (and unwanted pests). Chemistry products also enable indoor plumbing and efficient lighting, in addition to resilient flooring, roofing materials, protective coatings & sealants, and electrical insulation, just to name a few. The need to reduce energy consumption (and associated carbon emissions) in residential housing has driven demand for chemistry products in recent years. In fact, research shows the average single-family home contains nearly 33,100 pounds of chemistry materials,



including nearly 6,200 pounds of plastics.<sup>1</sup> In total, it's estimated that nearly 30.1 billion pounds of chemistry materials (including 5.6 billion pounds of plastic resins) were used in single-family home construction in 2023.

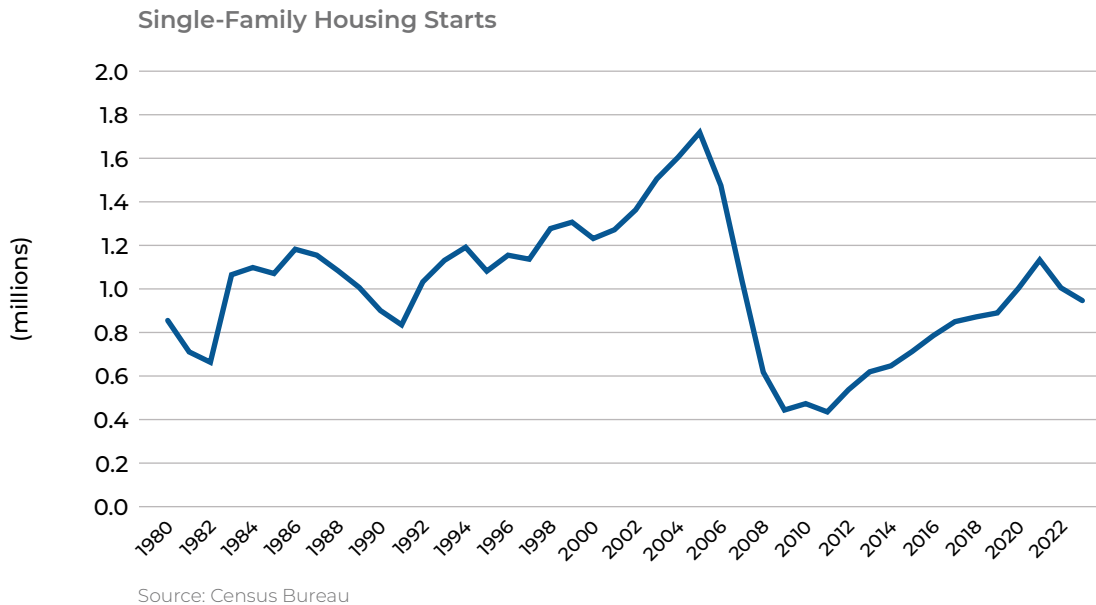
According to the U.S. Census Bureau, 909,200 privately-owned, single-family homes were started in the U.S. in 2023.<sup>2</sup> The construction of single-family housing is a major economic activity accounting for \$391 billion in output in 2023.

### **RECENT TRENDS IN SINGLE-FAMILY HOUSING**

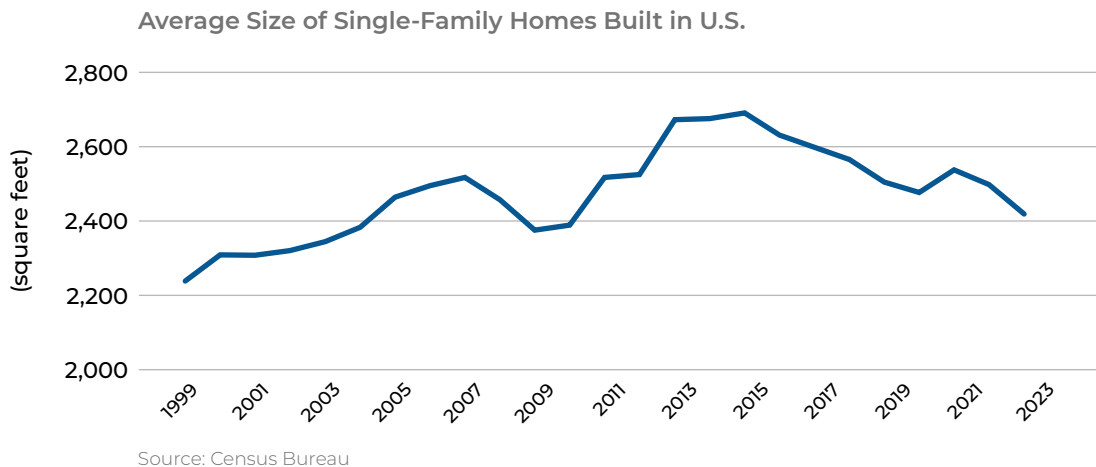
Single-family housing starts peaked in 2005 at 1.7 million, during the prelude to the financial crisis that was triggered by the bursting of a housing market bubble. Single-family starts plunged to historically low levels in the following years before starting to recover in 2012. During the COVID-19 pandemic that began in early 2020, mandatory lockdowns resulted in many employees working from home and students learning from home. The desire for additional space for home offices, coupled with an increase in remote access to work/school, demand for housing away from city centers surged. In addition, mortgage rates fell to historically low levels as the global economy grappled with the impacts of the pandemic. While just about every major economic indicator turned negative in 2020, housing starts (including single-family residences) rose in 2020 and continued upward in 2021, despite rising inflation. In March 2022, the Federal Reserve began a program of aggressive interest rate increases in an effort to reign in inflation. Because the cost of housing is directly related to mortgage rates, housing was one of the first sectors of the economy to slow. Housing starts declined in 2022 and again in 2023. The volume of chemistry used in single-family housing also contracted.

1 The nearly 33,100 pounds of chemistry in single-family housing is understated as these estimate exclude chemistry used in landscaping, appliances, HVAC, and lighting and other electrical fixtures (e.g. ceiling fans, doorbells, etc.).

2 As provided by the Census, a start occurs when excavation begins for the footings or foundation of a building. (<https://fred.stlouisfed.org/series/HOUST>)



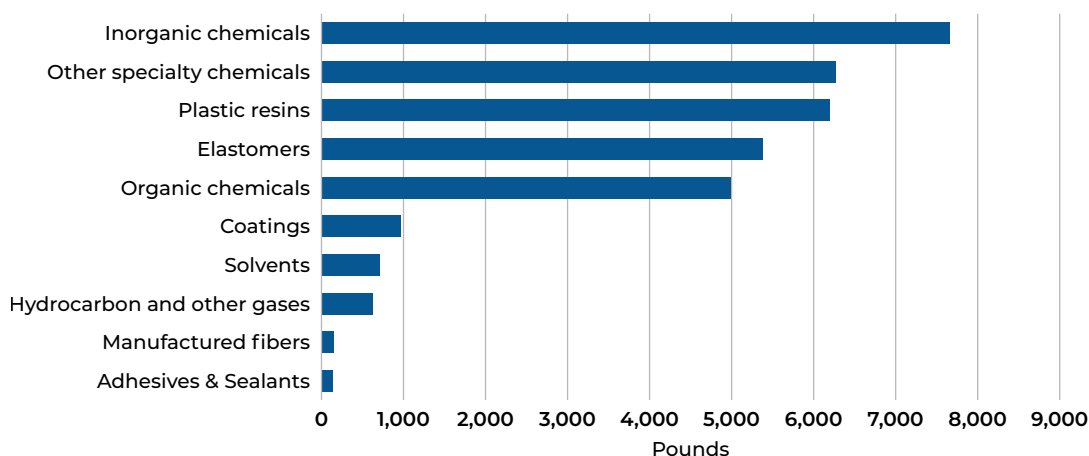
The average size of a single-family home built in the U.S. grew from 2,239 square feet in 1999 (when the Census Bureau first started tracking it) to 2,691 in 2016. The average home size fell from 2016 through 2020 as more starter homes were built. In 2021, the average home size rebounded to 2,538 as pandemic-motivated housing demand was driven by the need for home offices and more space for families. The average square footage of single-family homes fell in 2022 and 2023 as housing affordability fell and builders reduced home sizes to reduce costs.



# Chemistry Use in Building Materials

The choice of building materials for single-family homes depends on many factors, including climate, local building codes, affordability, and consumer preferences. This analysis attempts to capture the chemistry in building materials for the average single-family home constructed in the U.S. in 2023. The chemistry content of building materials can also vary significantly. Using data from Home Innovation Labs' *Builder Practices Survey*, the share of different materials used in various home construction applications was determined. For example, the data detail the share of kitchen countertops made from laminate, solid surface, engineered quartz, granite, etc. The chemistry composition of each type of material was derived from safety data sheets for representative products and other research.

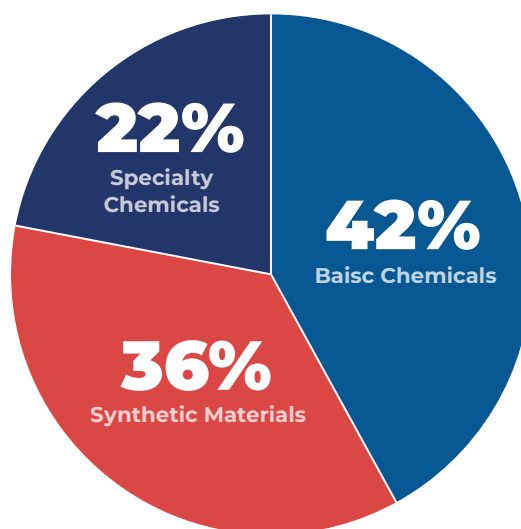
## Chemistry Used in Single Family Housing



The average single-family home contains nearly 33,100 pounds of chemistry used to produce building materials. Within that total, there is a tremendous diversity of chemistry materials.

The largest category is basic chemicals, including organic chemicals, inorganic chemicals, and industrial and other gases. Basic chemicals account for 42% of the volume. Synthetic materials (including plastic resins, elastomers, and fibers) account for 36%. The remaining 22% is specialty chemicals, including coatings, adhesives, sealants, and other specialty materials.

Share of Chemistry in Single-Family Housing by Major Category



## BASIC CHEMICALS

**Inorganic chemicals** are the largest category by volume with more than 7,700 pounds of inorganic chemistry used in building materials in the average single-family house. Inorganic chemicals used in building materials include inorganic fillers, materials used in composites, and inorganic pigments chemicals used in pressure treated wood, among others.

Nearly 5,000 pounds of **organic chemicals** were used in the production of building materials used in the average single-family house. These chemicals include organic binders used in engineered wood products, wood preservatives, waxes, propellants, and curing treatments.

**Solvents** are used in a number of applications in manufacturing building materials used in single-family housing. More than 700 pounds of organic and inorganic solvents were used in building materials that went into the average single-family home.

**Hydrocarbon** gases are also used in the construction of building products. The majority of this category is hydrocarbon and other gas-blowing agents used to manufacture foam-based products, such as insulation.



## SYNTHETIC MATERIALS

**Plastic resins** are used throughout home construction in nearly every application. From energy-saving insulation and building envelope technologies to pipes and electrical insulation to decorative surfaces. In 2023, the average single-family home contained nearly 6,200 pounds of plastic resins. See below for discussion of how plastic resins are used in home construction.

**Elastomers** are also an important material in home-building. Elastomers provide durable and reliable underlayment for roofing and flooring. Nearly 5,400 pounds of elastomers were used in a single-family home construction in 2023.

**Manufactured fibers** are predominantly used in carpet. While not every new single-family house included carpet, an average single-family house contains 151 pounds of manufactured fibers.

## SPECIALTY CHEMICALS

While perhaps the smallest by volume, **adhesives and sealants** play an outsized role in home construction. This category includes air-sealing in both manufactured windows and doors, as well as in building structure gaps. It also includes caulking between surfaces and fixtures. Adhesives (glues, tapes, mastics, etc.) are used throughout home construction and in the manufacture of products used in home construction. An average single-family home contains around 142 pounds of adhesives and sealants.

**Coatings** are used on the interior and exterior to protect and decorate surfaces. Coatings are also used to protect foundations in certain areas. The average single-family home contains nearly 1,000 pounds of coatings.

**Other specialty chemicals** include plastic additives, cement admixtures, flame retardants, and UV stabilizers. These specialty chemicals impart valuable characteristics to the materials they are applied to.



Table 1. Chemistry in Single-Family Housing (2023)

	Total (Million pounds)	Average per SF house
<b>Basic Chemicals</b>	<b>12,720</b>	<b>13,991</b>
Inorganic chemicals	6,971	7,667
Organic chemicals	4,533	4,985
Solvents	646	710
Hydrocarbon & other gases	571	629
<b>Synthetic Materials</b>	<b>10,660</b>	<b>11,724</b>
Plastic resins	5,631	6,194
Elastomers	4,891	5,379
Manufactured fibers	138	151
<b>Specialty Chemicals</b>	<b>6,712</b>	<b>7,383</b>
Adhesives & Sealants	129	142
Coatings	883	971
Other Specialty Chemicals	5,700	6,269
<b>Total</b>	<b>30,092</b>	<b>33,097</b>

## PLASTIC RESINS USED IN HOME CONSTRUCTION

An average single-family house contains nearly 6,200 pounds of plastic resins. In 2023, a total of 5.6 billion pounds of plastics were used in single-family home construction.

**Polyvinyl chloride (PVC)** and **chlorinated PVC (CPVC)** was the largest volume resin category with 2,285 pounds per house. PVC and CPVC are used in vinyl siding, plastics pipe, vinyl flooring, electrical wiring conduit/insulation and electrical tape.

**Urea-formaldehyde (UF)**, **melamine-formaldehyde (MF)** and **phenol-formaldehyde (PF)** resins were the next largest category with 1,837 pounds per house. These resins are used as binders in engineered wood products, including plywood, oriented strandboard, and fiberboard products.

**Polyurethanes** are used for insulation (including spray foam and in the construction of insulation panels) in addition to underlayment for carpet. An estimated 648 pounds of polyurethanes are used in single-family construction.



**Polyester polymers** are used in glass-fiber reinforced materials for bathroom fixtures like bathtubs, shower surrounds, countertops, window units, and shingles. An estimated 647 pounds of polyester polymers are used in single-family construction.

**Polyethylene** has many uses throughout home construction, including housewrap, flooring underlayment, pipe and radiant barriers. An estimated 316 pounds of polyethylene are used in an average single-family home.

**Polymethyl methacrylate (PMMA)** is used in countertops and bathroom fixtures. An estimated 182 pounds of PMMA were used in 2023 in single-family housing.

Another leading insulation material, **polystyrene (PS)** is used in the construction of insulating panels, forms and blocks. An estimated 162 pounds of PS resins are used.

**Polypropylene (PP)** also has many uses, including housewrap, shakes, carpet backing, films and tapes. A new single-family home contains an estimated 75 pounds of PP.

**Table 2. Plastic Resins Used In Single-Family Housing (2023)**

	<b>Total (Million pounds)</b>	<b>Average per SF house</b>
PVC/CPVC	2,077	2,285
UF/PF/Melamine	1,671	1,837
Polyurethane	590	648
Polyester	588	647
Polyethylene	287	316
Polymethyl methacrylate	169	182
Polystyrene	147	162
Polypropylene	69	75
Other	25	27
ABS	12	14
<b>Total</b>	<b>5,634</b>	<b>6,194</b>



# Chemistry in Single-Family Housing

From basement to attic, chemistry provides countless benefits to homeowners. Below are some key areas in housing and how building materials made with chemistry deliver key performance attributes. The following discusses how some chemistry products are used in selected applications within the home:



**Insulation:** Polystyrene, polyurethane foam, and fiberglass insulation are commonly used to provide thermal insulation in walls, floors, and attics. These materials trap air pockets to reduce heat transfer, improving energy efficiency and maintaining indoor comfort. The chemistry content of insulation materials is high. An average of nearly 4,000 pounds of chemistry can be found in insulation used to build a single-family home. There is a large degree of variability in the amount of insulation in a single-family home, depending, in large part, on geography. Homes built in colder climates typically use more insulation than homes built in more moderate climates.

**Building Envelope:** Chemistry products like air and vapor barriers, made from materials such as polyethylene and polypropylene, play an important role in creating a tight building envelope. These barriers resist moisture intrusion and air leakage, enhancing the structure's durability and energy performance. The chemistry content of sheathing materials is high, including binders for plywood. In 2023, an average of 4,755 pounds of chemistry were found in materials used in walls, roofing, and flooring.

**Roofing:** Chemistry products such as asphalt shingles, synthetic rubber membranes, and thermoplastic membranes are used for roofing applications. These materials support waterproofing, UV resistance, and durability, protecting the building from the elements. In terms of chemistry content in roofing materials, 6,000 pounds of chemistry were found in a newly built single-family home in 2023.


**Flooring:** Chemistry products play a crucial role in flooring materials such as vinyl, laminate, engineered wood, and carpet. These materials contain synthetic resins and fibers that provide durability, water resistance, and aesthetic appeal. Chemistry content varies by material, but an average of 860 pounds of chemistry content were found in various flooring materials in a single-family home built in 2023.

**Siding:** Vinyl siding and engineered wood siding (which include a high chemistry share) are popular exterior cladding options, in addition to brick and stone. These materials offer weather resistance, low maintenance, and a range of colors and textures to enhance curb appeal. While chemistry content varies by material, an average of 1,700 pounds of chemistry content can be found in various siding materials used in building a single-family home.

**Kitchen and Bathroom Fixtures:** Chemistry products are utilized in the manufacturing of kitchen and bathroom fixtures such as countertops, sinks, and tubs. Materials like laminate, solid surface acrylic, cultured marble, and engineered stone offer durability, stain resistance, and design flexibility for these applications. Kitchen and bath cabinetry also contain chemistry products, including binders for engineered wood products, laminates, adhesives, and coatings. The chemistry content varies by material, but 488 pounds of chemistry were found in various fixtures in an average single-family home built in 2023.

**Pipe and Plumbing Fixtures:** Chemistry products are commonly used for plumbing pipes and fittings. Popular materials in this category include PVC, CPVC, and polyethylene. These materials are lightweight, corrosion-resistant, and relatively easy to install, supporting reliable water distribution and drainage systems. While chemistry content varies by material, an average of 580 pounds of chemistry were found in pipes and various plumbing fixtures in a newly built single-family house in 2023.





**Adhesives, Binders & Sealants:** A large and diverse portfolio of products, this category includes materials that bond, seal, and finish various building materials, including structural components, windows, doors, bathroom and kitchen fixtures. They are also used to help seal gaps and cracks in homes to reduce air leakage and intrusion. These products provide strong adhesion, weather resistance, and durability, enhancing the performance and longevity of construction assemblies and reducing energy losses. In 2023, about 142 pounds of these materials were used in building a single-family house.

## Conclusion

Homebuilding has come a long way over the last century. Each year, new and innovative materials come to the market to make homebuilding more comfortable and sustainable - from enhancing energy efficiency to reducing embodied carbon to improving building resiliency. The products of chemistry play an important role in the construction of single-family homes and meeting increasingly stringent energy codes. With more than 30.1 billion pounds of chemistry materials used in 2023, single-family housing is an important end-use market for the U.S. chemical industry.







## Methodology & Sources

The volume of chemistry in single-family housing was determined through data on the use of building materials available in the *Builder Practices Survey* from the [Home Innovation Research Labs](#),<sup>TM</sup> an affiliate of the National Association of Homebuilders. The chemistry content of each item was estimated from publicly available data, including building product safety data sheets (SDSs) and internet building & construction forums. Additional research was conducted to supplement categories not covered in the Building Practices Survey, including coatings, adhesives, and sealants used directly in construction, kitchen & bathroom cabinetry, framing, and electrical wiring.

## Disclaimer

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# ACC's Economics & Data Analytics Department

The Economics & Data Analytics Department provides a full range of statistical and economic analysis and services for ACC and its members and other partners. The group works to improve overall ACC advocacy impact by providing statistics on the chemical industry as well as preparing information about the economic value and contributions of the chemical industry to the economy and society.

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