Chemical Sector Profile

CISA
CYBER+INFRASTRUCTURE

The U.S. Chemical Sector converts raw materials into **more than 70,000 diverse products** essential to modern life and distributes those products to **more than 750,000 end users throughout the Nation**. Several hundred thousand U.S. chemical facilities—ranging from petrochemical manufacturers to chemical distributors—use, manufacture, store, transport, or deliver chemicals along a complex, global supply chain. End users include critical infrastructure sectors, making **the uninterrupted production and transportation of chemicals essential for national and economic security**.

Impact on U.S. Economy

The U.S. chemical industry is responsible for more than a quarter of the U.S. GDP, supports the production of almost all commercial and household goods, and is essential to economic growth.

The U.S. chemical industry is a
$768 billion
enterprise that supports more than
25%
of total
U.S. GDP

96%
of U.S. goods in 2016 were manufactured using Chemical Sector products

The U.S. chemical industry is one of the world's
largest chemical producers
15%
of the world's chemicals come from the U.S.

Generation of U.S. Employment

From research and development to manufacturing, the U.S. chemical industry employs nearly 800,000 people, while creating jobs in the many other industries it touches.

The U.S. Chemical Sector directly employs nearly
800,000 employees

Every job created by the business of chemistry generates
6.8 jobs elsewhere

6 million
U.S. jobs created

Contribution to U.S. Exports

The business of chemistry is America's largest exporting sector, supplying an eighth of the world's chemical needs.

Total value of U.S. chemical exports per year
$174 billion

Chemicals and related products make up
10 cents of every $1 of U.S. exports

Components of the Chemical Sector

The U.S. Chemical Sector is made up of five distinct components: agricultural chemicals, basic chemicals, specialty chemicals, consumer products, and pharmaceuticals. Each component supports a specific and integral part of America's chemical needs.

Functional Areas of the Chemical Sector

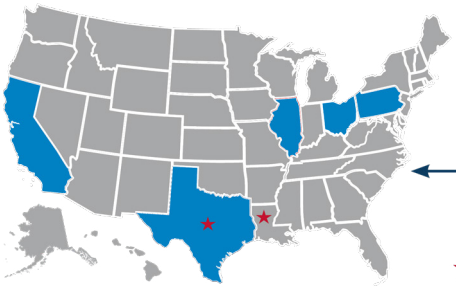
Manufacturing Plants
Convert raw materials into intermediate and end products

Transportation Systems
Transport chemicals to/from manufacturing plants, warehouses, and end users

Warehousing/ Storage
Provide downsized repackaging and bulk storage

End Users
Typically consume the chemical purchased

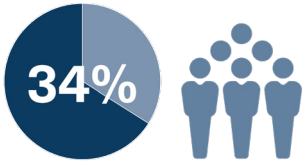
Chemical distributors deliver more than **9 tons** of chemical sector products **every 8.4 seconds**



11,114
U.S. chemical manufacturing facilities (2016)

States with the greatest concentration of facilities: California, Texas, Ohio, Illinois, and Pennsylvania

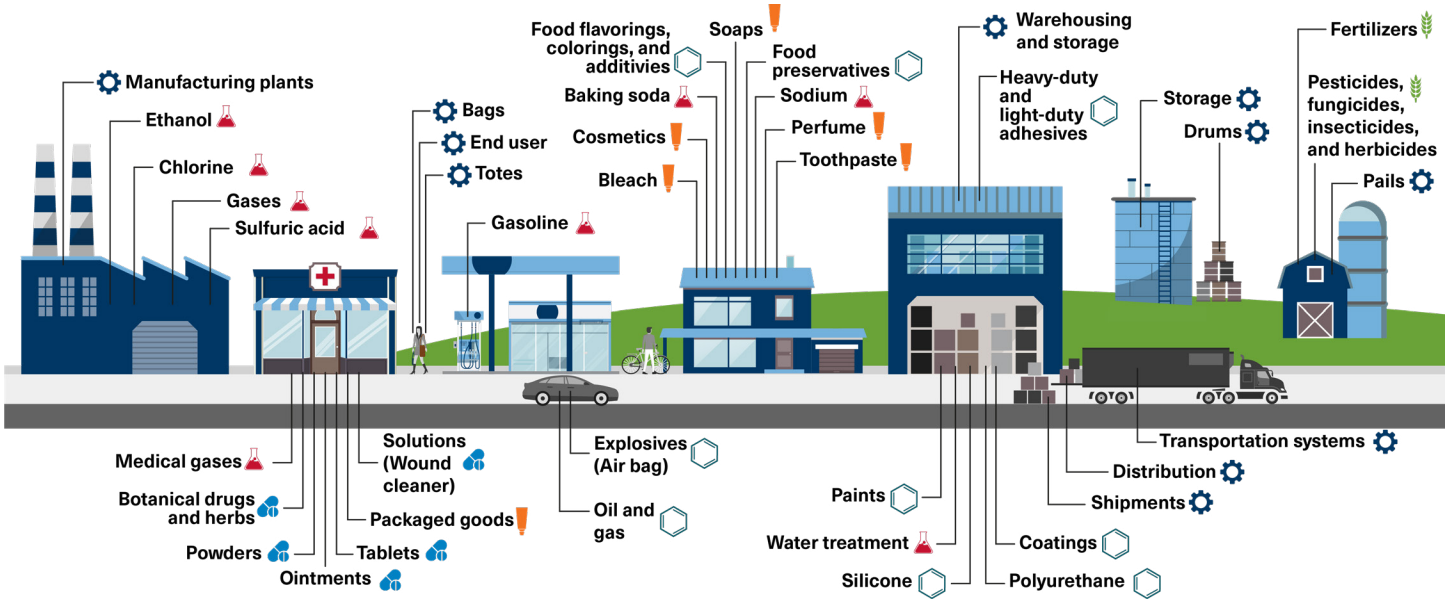
★ Louisiana and Texas account for about 70% of all primary petrochemicals produced in the U.S.



of chemical manufacturing facilities are owned and operated by **small and medium enterprises** (employ <500 people)

The Chemical Sector: Integral to Everyday Life

Nearly all goods in use every day in the U.S. are manufactured using Chemical Sector products. These goods are found in homes, offices, drug stores, and farms across the Nation.



Page 1: American Chemistry Council (ACC), Elements of the Business of Chemistry, 2017; DHS, Chemical SSP, 2015; National Association of Chemical Distributors (NACD), 2019, NACD Responsible Distribution.

Page 2: ACC, Elements of the Business of Chemistry, 2017; ACC, Elements of the Business of Chemistry, 2018; Census, Geographic Area Series: County Business Patterns, 2016, NAICS: 3251, 3252, 3253, 3255, 3256, 3259; Census, Statistics of U.S. Businesses Employment and Payroll Summary, 2015; DHS, Chemical SSA Fact Sheet, 2017; DHS, Chemical SSP, 2015; NACD, 2019, NACD Responsible Distribution.

Agricultural Chemicals

The agricultural chemical industry supplies farmers and home gardeners with fertilizers, herbicides, pesticides, and other agricultural chemicals. The segment also includes companies involved in the formulation and preparation of agricultural and household pest control chemicals, as well as companies responsible for manufacturing and storage.

$29.6 billion
in chemical sales to the agriculture industry in 2016

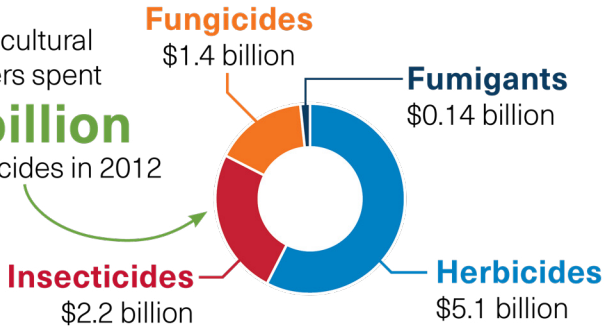
471 facilities

$41.1 billion
total value of shipments distributed

35,100 employees

Pesticides

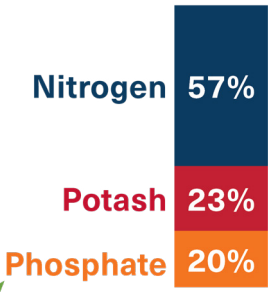
U.S. agricultural producers spent
$9 billion
on pesticides in 2012



Fertilizers

U.S. agricultural producers spent
$71.8 million
on fertilizer in 2016

The U.S. consumed
23.2 million
tons of fertilizer in 2014



Consumer Products

Consumer products include packaged products often referred to as "household products." This includes everything from soaps and detergents to oral hygiene and hair and skin care products to personal care products (e.g., cosmetics, deodorants).

In 2015, the U.S. consumer goods market was the **largest in the world**

$446 billion

$74.4 billion
total value of shipments distributed

Each year, the average U.S. consumer spends
$81.65
on soaps and detergents

Types of Products

Soap · Detergents · Bleaches · Toothpaste · Cosmetics · Perfume · Paints

Soap, Cleaning Compounds, and Toilet Preparation

2,268 facilities

108,200 employees

Page 3: ACC, Elements of the Business of Chemistry, 2017; Census, Geographic Area Series: County Business Patterns, 2016, NAICS: 3253; Census, Geographic Area Series: County Business Patterns, 2016, NAICS: 3256; EPA, Pesticides Industry Sales and Usage, 2017; EPA, Report on the Environment, 2018; SelectUSA, Consumer Goods Spotlight, 2019; Statista, U.S. household expenditure on soaps and detergents, 2017; USDA, Fertilizer Use and Price, 2018.

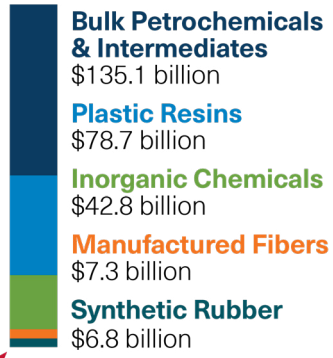
Basic Chemicals

The basic chemicals segment produces both inorganic and organic chemicals. Organic chemicals are used in the production of other chemicals and to make products such as dyes, plastics, and **petrochemical products**. Inorganic chemicals usually are used to make solid and liquid chemicals and **industrial gases**; sodium, **sulfuric acid**, and **chlorine** are some of the most common. Inorganic chemicals also serve as catalysts in the manufacture of chemicals (used to speed up or aid a reaction).

1,277 facilities

151,700 employees

$271 billion
total value of shipments distributed



Petrochemical

More than **230 plants** producing petrochemicals in the U.S.

Each day **1.8 billion gallons** of crude oil, refined projects, and natural gas liquids and **311 million pounds** of plastic resins move through U.S. infrastructure networks.

Petrochemical plants produce **resins** that are used in a wide variety of products:

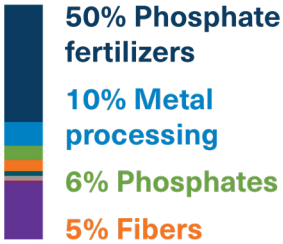
- Car parts
- Water bottles
- Medical devices
- Food packaging containers

Sulfuric Acid

41 million tons of sulfuric acid are produced each year in the U.S.

16% of the world's production (255 million tons)

Used to make **hundreds of compounds** needed by almost every industry; **uses of sulfuric acid** include:



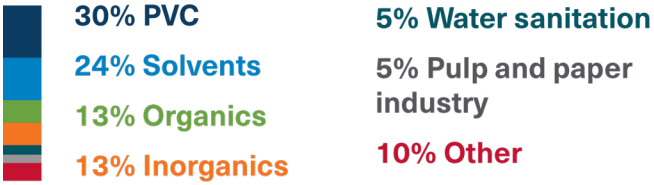
Chlorine

10 million tons of liquid chlorine
+
2 million tons of chlorine gas
=
12 million tons of chlorine produced annually

$8 billion+ in annual sales

20,000 employees

Uses of Chlorine



Industrial Gases

$12.2 billion
worth of products produced annually

60,000 employees

Each job **generates 2.1 more jobs** elsewhere in the economy, **contributing $24.3 billion to the U.S. economy**

Industrial gases are used in a **wide variety of applications**, including:

- Medical
- Electronics
- Industrial
- Food & beverage
- Manufacturing

Page 4: ACC, Chlorine Production, 2017; ACC, Elements of the Business of Chemistry, 2017; American Fuel & Petrochemical Manufacturers (AFPM), 2018 Annual Report, 2018; AFPM, The Fuel and Petrochemical Supply Chains, 2018; Census, Geographic Area Series: County Business Patterns, 2016, NAICS: 3251; CollegeGrad, Chemical Manufacturing, 2019; Essential Chemical Industry, Sulfuric Acid, 2016; The Chlorine Institute, Production and Shipment Report, 2017; The Essential Chemical Industry, Chlorine, 2016; Compressed Gas Association, 2018.

Pharmaceuticals

The pharmaceutical industry includes the manufacture, extraction, processing, purification, and packaging of chemical materials to be used as medications. Pharmaceutical facilities primarily engage in one or more of the following: manufacturing of biological and medical products; processing of botanical drugs and herbs; isolating active medical principles from botanical drugs and herbs; and/or manufacturing of pharmaceutical products intended for internal and external consumption in forms such as tablets, capsules, ointments, powders, and solutions.

2,366 facilities

$202 billion
total value of shipments distributed

247,270 employees

Pharmaceutical Preparation

1,315
facilities

$152 billion
total value of shipments distributed

147,510
employees

Biological Products

301
facilities

$26 billion
total value of shipments distributed

43,410
employees

Diagnostic Substances

234
facilities

$12 billion
total value of shipments distributed

27,490
employees

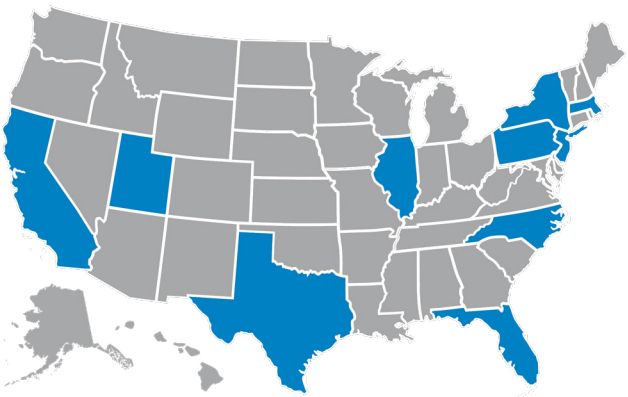
Medicines

516
facilities

$12 billion
total value of shipments distributed

28,860
employees

Top 10 pharmaceutical manufacturing states by number of facilities



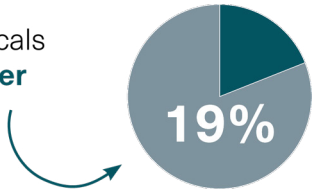
	State	# of Fac.
1	CA	430
2	NJ	161
3	NY	142
4	FL	135
5	TX	116
6	MA	90
7	PA	88
8	NC	76
9	IL	73
10	UT	73

Page 5: Census, Geographic Area Series: County Business Patterns, 2016, NAICS: 3254; Census, Industry-Product Analysis Industry Shipments by Products and Receipts for Services, 2016, NAICS: 325411, 325412, 325413, 325414.

Specialty Chemicals

Specialty chemicals are individual molecules or mixtures of molecules (i.e., formulations) that are manufactured on the basis of a unique performance or function. Many other sectors rely on specialty chemicals for their products, including automotive, aerospace, agriculture, and cosmetics and food, among others.

The **market share** for specialty chemicals in North America is **significantly higher** than the global average.



$89.6 billion
total value of shipments distributed

Adhesives and Sealants

Acrylates/anaerobic adhesives
Adhesive used to keep nuts tight on bolts

Amino resins
Bonding of layers in plywood and of particles in particle board

Animal glue
Binding of abrasives in sandpaper and other grinding materials

Butyl rubber/isobutylene
Additive for hot-melt and pressure-sensitive adhesives and window sealants

Casein
Labels on bottles that stay on in ice water and are recyclable

Polyolefin/ethylene copolymer
Hot melts

Polyurethane
Bonding soles to the bodies of shoes; food packaging

Polyvinyl acetate
Book bindings and labels

Natural rubber
Self-adhesives (e.g., envelopes)

Paints
Vehicle paint, traffic marking paint, food paints

Silicone
Bathtub and shower sealants; car applications

Starch
Corrugated cardboard bonding

Paint, coating, and adhesive manufacturing →

60,060 employees

Food Additives

The Food and Drug Administration currently lists
3,000 food additives
approved for food use in the U.S.

Preservatives
(e.g., propionic acid, nitrates, benzoates)

Flavorings
(e.g., fruit flavors, sweeteners, butter flavors)

Processed food additives
(e.g., potassium sorbate, propylene)

Flavors and Fragrances

$1.4 billion
in annual sales in 2002

Explosives

4.5 billion
tons of explosives used in the U.S. in 2015

- Fragmenting rock formations for oil and gas extraction
- Blasting during mining and quarry processes
- Inflation devices such as vehicle airbags

Page 6: ACC, Elements of the Business of Chemistry, 2017; BCG, Specialty Chemical Distribution in North America, 2016; Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF), Explosives Fact Sheet, May 2018; Census, Geographic Area Series: County Business Patterns, 2016, NAICS: 3255; Chemistry Explained, Adhesives, 2018; FDA, Overview of Food Ingredients, Additives & Colors, 2018.

Regulatory

As the majority of Chemical Sector assets are privately owned and operated, effective security and resilience planning requires a shared commitment between the public and private sectors to implement the most effective risk management strategies throughout the sector.

Federal Agencies

Federal agencies regulate the **manufacturing, storage, processing, transportation, and use of chemicals*** through the following mechanisms:

Department of Homeland Security

Cybersecurity and Infrastructure Security Agency

Chemical Facility Anti-Terrorism Standards

3,355 facilities regulated (as of 2018)

Transportation Security Administration

Rail Transportation Security Final Rule

46 key urban areas covered by secure chain-of-custody inspections

U.S. Coast Guard

Maritime Transportation Security Act of 2002

3,200 facilities of all types covered (as of 2013)

Environmental Protection Agency

800,000 regulated facilities (as of 2018)

Department of Transportation

Pipeline and Hazardous Materials Safety Administration

13,829 shippers covered by the security plan and training requirements (as of 2017)

Department of Health and Human Services

Food and Drug Administration

$1 trillion worth of products regulated per year including drugs, cosmetics, and medical and consumer products

Department of Labor

Occupational Safety and Health Administration

700 enforcement inspections of chemical manufacturing facilities in 2017

Department of Justice

Bureau of Alcohol, Tobacco, Firearms and Explosives

9,815 licensee/permittees are subject to security rules (as of 2017)

**The regulatory scope of these agencies/programs extends beyond the domain of the Chemical Sector.*

In addition to Federal regulations, **the chemical industry is subject to any regulations states might impose** on facilities doing business within their boundaries.

Page 7: ATF, ATF by the numbers, 2018; DHS, CFATS Monthly Statistics, 2018; DHS, Chemical SSP, 2015; DHS, Fact Sheet, 2008; EPA, Enforcement Data and Results, 2018; Occupational Safety and Health Administration, Inspections within Industry, 2017, NAICS: 325; PHMSA, Hazardous Materials Registration Status, 2017.