

State of the Industry

2015 FERTILIZER STATE OF THE INDUSTRY REPORT



The
Fertilizer Institute
Nourish, Replenish, Grow



Fertilizer State of the Industry Report

Fertilizer: State of the Industry Report
2013-2014 Data
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Table Of Contents

U.S. Fertilizer Industry: State of the Industry Report	2
President's Letter	5
SECTION ONE - INTRODUCTION	7
Industry Overview	8
Challenges Ahead – Policy and Sustainability Challenges	10
Report Objectives and Structure	12
SECTION TWO - ECONOMIC AND SOCIETAL BENEFITS	13
Economic Benefits	14
Non-Agricultural Uses	18
Societal Benefits	18
Employee Safety	19
Community Safety	22
ResponsibleAg	23
SECTION THREE - FERTILIZER INDUSTRY OPERATIONS	25
Energy	27
Greenhouse Gas Emissions	31
Land Conservation and Rehabilitation	34
Water	35
SECTION FOUR - FERTILIZER TRANSPORTATION	39
SECTION FIVE - ENABLING NUTRIENT STEWARDSHIP	46
4R Initiative	47
Role of the Agronomic Professional	50
4R Research	51

The background of the slide is a photograph of a sunset or sunrise. The sky is filled with vibrant orange and yellow hues, with some darker, textured clouds visible. A bright light source, presumably the sun, is positioned low on the horizon, creating a strong glow. Below the horizon line, the surface of a body of water is visible, reflecting the warm colors of the sky. At the very bottom of the image, there is a solid white horizontal bar.

President's Letter

I am pleased to introduce The Fertilizer Institute's (TFI) first State of the Industry Report. This publication is the first-of-its kind for TFI and complements reports that have been published over the past several years by companies in the fertilizer industry. As with our member companies' individual sustainability reports, this document tracks industry performance on environmental, economic and social indicators. We hope that it communicates our collective commitment to continuous improvement on key sustainability indicators and demonstrates our willingness to partner with farmers, environmental and conservation organizations and other stakeholders in pursuit of these goals.¹

The future of the fertilizer industry depends on our ability to provide goods and services that help growers feed the world, improve lives, and protect the environment. In short, sustainable growth requires the industry to balance economic performance with environmental and social responsibilities. Measuring and evaluating our efforts provides a way to track performance and identify areas we can target for improvement.

Some report highlights:

ECONOMIC CONTRIBUTION: The United States is the fourth-largest producer of nitrogen-based fertilizers in the world and the second-largest producer and exporter of phosphate fertilizer¹. The companies and facilities that produce, blend and sell fertilizer generate more than \$58 billion in direct economic impact and provide in excess of 80,000 direct U.S. jobs³. When combined with the 372,000 indirect jobs the industry supports, this adds up to a total employment impact of 452,000 jobs. Many of these jobs rank among the best in their communities.

NATURAL RESOURCE CONSERVATION: Water and energy are essential to our operations, and the industry endeavors to identify and implement processes for their conservation and re-use. In fact, the companies whose data are aggregated in our report recycle and re-use surface and groundwater an average of four times during the fertilizer production process.

NUTRIENT STEWARDSHIP: Moving beyond the production plant, our members are engaged in providing agronomic expertise to their farmer customers. This technical support helps farmers protect the environment and benefit society while remaining profitable and is based on the 4R Nutrient Stewardship framework (use of the right fertilizer source at the right rate, the right time and in the right place).

TFI hopes this initial State of the Industry Report provides readers with a deeper understanding of the many steps the fertilizer industry is taking to be sustainable. We welcome your feedback on the content of this report and also encourage you to contact us with inquiries on our sustainability efforts.

Sincerely,



Chris Jahn
President
The Fertilizer Institute

SECTION ONE

Introduction



Industry Overview

Experts estimate that there will be more than nine billion people on our planet by 2050. Fertilizer plays a key role in meeting the challenge of feeding this growing population. Fertilizer helps increase soil fertility, resulting in more abundant crops. Without fertilizer, significantly more land would need to be brought into production to meet global food production needs. In North America during the past 40 years, farmers have been able to use less land while tripling food production due in part to the use of fertilizer.

As plants grow, they take up nutrients from the soil that must be replenished after each harvest. Nutrients from fertilizers play an essential role in bridging the gap between soil nutrient availability and crop nutrient needs. Three primary nutrients are necessary for plant growth, and all must be present in soil in the right amount to grow healthy crops.



N

NITROGEN (N) is the first primary nutrient. It is essential in the formation of protein, and protein makes up much of the tissues present in most living things. The earth's atmosphere is about 78 percent nitrogen by volume, and all living things must have it to survive. However, most plants can't get their nitrogen directly from the air and require nitrogen fertilizer. Nitrogen fertilizer is made by capturing nitrogen from the air using natural gas as a feedstock. This method is called the Haber-Bosch process.



P

PHOSPHORUS (P) is another one of the "big three" primary nutrients. Phosphorus is involved in many processes critical to plant development. Key among them is photosynthesis, the process that plants use when converting sunlight to energy. The phosphorus in most commercial fertilizers comes from phosphate rock found in fossil remains originally laid down beneath ancient sea beds. Fertilizer manufacturers mine deposits of phosphate rock to provide P for a variety of commercial fertilizer blends.



K

POTASSIUM (K), the third primary nutrient, is also known as "potash." Up to 98 percent of K in the soil is unavailable to plants in its existing form, making potash fertilizer essential for crop production. Potassium is particularly important in carbohydrate and starch synthesis, and it also helps plants resist wilting. Potassium, like nitrogen, also helps plants produce protein as they grow. Like phosphate, potassium is mined from mineral deposits.



Challenges Ahead – Policy And Sustainability Challenges

Feeding the world is of critical importance, and it must be done in a way that protects people and natural resources.

The availability of land for growing crops is shrinking both in the United States and globally. Yet, the demand for food is rising as the population grows. Helping farmers maximize crop yields on the most productive acres while protecting air and water resources is an ongoing challenge for the fertilizer industry. Use of more nutrients than plants need, and conversely, the use of too few nutrients, can have negative impacts on the environment and farm profitability.

4R Nutrient Stewardship (use of the right fertilizer source at the right rate, the right time and in the right place) is a framework for sustainably managing nutrients. Grower adoption of the 4Rs is currently difficult to quantify, in large part for definitional reasons. Farmers, for example, might not consider “precision agriculture” to be a 4R practice or set of practices, when in fact, it is. Industry efforts with our customers to improve 4R adoption and evaluation with associated metrics are important to helping address regional hotspots where excess nutrients are contributing to impaired water quality.

Energy poses yet another challenge to the fertilizer industry. Natural gas is used as a feedstock in the production of nitrogen and in





manufacturing dry fertilizers such as potash and phosphate. It can account for between 70 and 90 percent of the fertilizer manufacturing cost. Government policies that encourage fuel switching to natural gas from other sources affect demand by creating energy supply or pricing issues. This can impact the U.S. fertilizer industry's competitiveness in the global market.

Nitrogen fertilizer is produced in regions with close access to a natural gas supply and phosphate and potash are mined in areas of the world where mineral deposits exist, as well as reliable and reasonably priced transportation. A ton of fertilizer might travel by several means, including ocean-going ships, railroads, trucks and river barges, before reaching the farmer. Having a reliable transportation network is critical to the fertilizer industry and its customers. Disruptions in rail service, especially, can negatively impact a farmer's ability to apply the right fertilizer at the right time.

Certain fertilizers are classified as hazardous materials and must be handled using practices aimed at ensuring health, safety and security of employees, suppliers, customers, communities and environment. Many of these measures are mandated by federal and state laws. Similarly, some nitrogen fertilizers could be misused should they fall into the wrong hands, and companies in the industry employ actions aimed at ensuring that infrastructure, supply chain, and employee practices keep products secure.

Report Objectives And Structure

This State of the Industry Report is a pilot quantitative and qualitative data collection program to understand more fully the economic, social, and environmental impacts of the U.S. fertilizer industry. This baseline data is a first step to quantifying industry successes and tracking performance for continuous improvement.

All quantitative metrics data in this report represent The Fertilizer Institute's (TFI) member-related products (nitrogen, phosphate and potash materials produced in, imported to, or transported within the United States) for 2013 and 2014. For the purpose of reporting capital expenditures, which can vary significantly from year to year, TFI included annual average data over a three-year timeframe (2012 to 2014). The program boundary includes parameters associated with the fertilizer industry in the United States from TFI member companies, including fertilizers and associated raw materials and packing materials manufactured on U.S. soil or imported into the U.S. market. TFI considers the following operations to be within the program boundary: fertilizer manufacturing sites, crop nutrient wholesalers, agricultural retail facilities including but not limited to blending facilities, and specialty crop nutrient providers.

The 13 companies that participated in this pilot program include:

Agrium (including Crop Production Services)

CALAMCO

CF Industries

Coffeyville Resources Nitrogen Fertilizers

Compass Minerals

Growmark FS

Koch Fertilizer/Koch Agronomic Services

LSB Industries

OCI Beaumont LLC

PotashCorp

SQM North America

The Mosaic Company

Willard Agri-Service

Member companies provided data confidentially to a third party aggregator working with TFI to develop this report. To protect an individual company's private data, totals are only provided if three or more companies submitted data for a particular metric. The number of companies providing data for a particular metric is disclosed within each section in the report.



SECTION TWO

Economic and Societal Benefits



Economic Benefits

The U.S. fertilizer industry is one of the world's largest. The United States is the fourth-largest producer of nitrogen-based fertilizers in the world and the second largest producer of phosphate. The U.S. fertilizer industry generates more than \$139 billion in economic benefit and provides 80,099 direct jobs and 372,603 indirect jobs for a total of more than 452,702 U.S. jobs⁴.



Capital Investment By OCI Beaumont LLC Leads to Reduced Energy Use and Emission Reductions

OCI Beaumont LLC operates an integrated methanol and ammonia unit in Beaumont, Texas. The methanol plant was built in 1967 and the ammonia loop was added in 2000. Both plants were mothballed for seven years, from 2004 until 2011. By the middle of 2012, both the ammonia and methanol units were once again in operation and a project was initiated to debottleneck both units. In the first quarter of 2015, OCI Beaumont LLC executed the final phase of this project, which resulted in a 25 percent increase in both the methanol and ammonia unit capacities. The engineering for the project was completed by Houston-based IHI and included the installation of Best Available Control Technology (BACT) to reduce nitrogen oxide emissions and save on energy consumption. Newly installed equipment included a Selective Catalytic Reduction (SCR) on the two Foster Wheeler Furnaces, ultra-low NOx burners, as well as an additional flare and a saturator.

Another major component of the project was to improve the reliability of the facility. Outdated equipment was replaced or refurbished, electrical upgrades were implemented and additional instrumentation was installed. The plant was successfully commissioned and within four weeks, both units were running stable above design capacity. With close to two million work hours completed, the safety performance was deemed excellent as only one medical treatment incurred. Considering the complexity of the project, essentially building a plant within an existing plant, this was a significant achievement.

Capital Investments

Fertilizer companies invest significantly in plants and equipment based in the United States, where much of the raw nutrient extraction and production process take place. Capital investments that TFI member companies make directly contribute to the economic stability of local communities and the United States as a whole.

To understand the magnitude of capital investments made by our industry, annual capital investment data were assessed from participating members as part of this initial reporting effort. Companies provided the total amount spent on capital investments in 2012, 2013 and 2014 to allow for a more representative annual average. Ten TFI member companies provided data for the capital investments metric.

Across the three-year period, the 10 reporting TFI member companies made aggregate

total capital investments of \$1.9 billion per year on average.



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The U.S. fertilizer industry generates more than

\$139 billion in economic benefit

Safety Leadership Coaches

POTASHCORP

PotashCorp's goal is to become one of the safest resource companies in the world. Safety leadership coaching is a key initiative that the company has undertaken to help it reach this target. Within the company's potash, phosphate and nitrogen divisions, Safety Leadership Coaches work with front-line supervisors to help them build their skills as safety leaders and become comfortable with the role.

The Coaches spend classroom time with the supervisors, before moving to one-on-one infield training with each of them to assess how effectively they communicate about safety with the employees they supervise. The goal is to help the supervisors develop the tools they need to have meaningful safety conversations with their workers. This includes stopping the job, gathering the entire crew, reinforcing good work and showing an overall concern for the well-being of the team.

During the course of instruction, the Safety Leadership Coaches explain that it is essential that they build trust with the supervisors they are instructing so that the process remains collaborative and positive. "It is important that our process is not negative in any way," says Ronnie Duncan, a Safety Leadership Coach in PotashCorp's nitrogen division.

**Non-Agricultural Uses Convey
Additional Societal Benefits**

Beyond use in agriculture, chemical components of fertilizer are used for a variety of industrial and commercial purposes. Nearly 20 percent of nitrogen demand globally is for chemical processing, reduction of NOx emissions from power plants, water and wastewater treatment, and in industries such as petroleum, rubber, metals and mining, and pulp and paper. One industrial use of nitrogen produced by TFI's members is diesel exhaust fluid (DEF), which helps reduce nitrogen oxide emissions of heavy-duty trucks by up to 90 percent and improve fuel efficiency by up to five percent. Phosphates are added to foods, animal feeds, and are used as a flame-retardant on products including wood, fabric and plastics. Potash is used as an input in various food products, in animal feed, in soaps and water softeners, among other uses. The companies that participated in this pilot project reported 37 percent of the nitrogen produced in 2014 and 19 percent of the combined phosphate and potash production were for non-fertilizer purposes.



\$13.2 billion
in revenues to federal,
state, and local
governments
through taxes

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The U.S. fertilizer industry
employs more than

452,000
people



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Societal Benefits

In addition to employing more than 452,000 people (direct and indirect employment) in the United States, the fertilizer industry contributes \$13.2 billion in revenues to federal, state, and local governments through taxes. Fertilizer companies focus on ensuring the safety of their workers and of the larger communities in which they live and work while playing an indispensable role in the food value chain.



Employee Safety

TFI member companies have site-specific worker safety programs in place. They work to ensure safe handling of fertilizer and related products during manufacture, transportation, sales and application.

High-paying desirable manufacturing jobs account for 26 percent of the U.S. fertilizer industry's workforce. The fertilizer industry has a strong commitment to employees and the communities around their facilities. Providing health and safety data is a key metric to illustrate the fertilizer industry's commitment to the men and women serving as employees. Oftentimes positive trends in morale and productivity are linked to low injury and absentee rates. All employers in the United States are required by law to maintain records related to work-connected injuries and illnesses. Fertilizer companies report this data to the U.S. Occupational Safety and Health Administration (OSHA) Bureau of Labor and Statistics on an annual basis.

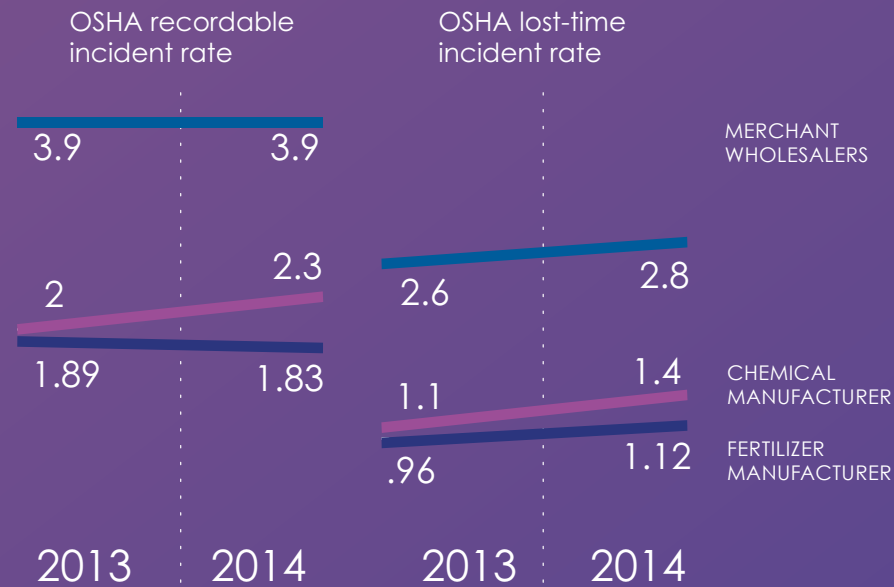
For the purposes of understanding the safety performance of our industry, we have gathered employee safety data from our member companies as part of this initial report. Participating companies provided metrics for OSHA recordable incident and OSHA lost-time incident rates.

OSHA recordable incident rate is calculated by multiplying the number of recordable cases by 200,000, and then dividing that number by the company's number of labor hours. By way of comparison, the total recordable incident rate for the chemical manufacturing sector, of which fertilizer manufacturing is a part, was 2.0 in 2013 and 2.3 in 2014. The lost time incident rate for this sector was 1.1 in 2013 and 1.4 in 2014. The total recordable incident rate for merchant wholesalers of nondurable goods, of which agricultural retail is a part of, was 3.9 for both 2013 and 2014. The lost time incident rate for this sector was 2.6 in 2013 and 2.8 in 2014.



**26% of
fertilizer industry
jobs** are related to
manufacturing and are
high paying, desirable jobs.

Safety performance for 11 TFI member companies represents 59 percent of U.S. fertilizer production capacity. In terms of both recordable and lost-time incidents, industry's safety record is better than that of its peers in chemical manufacturing and merchant wholesaling of nondurable goods.





Public Safety

AGRIUM

Agrium is an involved and responsive partner working with communities and industry associations, such as TFI, to address public safety issues associated with fertilizer production, distribution and retail operations. At Agrium's wholesale production locations, the company provides training focused on ammonia to local fire departments adjacent to the facilities. Wholesale facilities also provide ammonia training to fire departments along key transportation routes for its product shipments. The training provides information on ammonia characteristics and effects on the environment, as well as the appropriate emergency response techniques for response agencies and directions for accessing specialized information and resources from Agrium. Wholesale facilities are also active members of local emergency response organizations and are prepared to respond to local community-based emergencies such as fires, rescues and natural disasters. Additionally, at Agrium retail locations, the company trains local fire departments on an ongoing basis. At a corporate level, Agrium provides crisis communications training to all major Agrium facilities and supports youth farm safety education throughout North America.

Community Safety

As part of the focus on safety, TFI member companies regularly engage with their communities to educate and train first responders and others about potential incident scenarios and appropriate prevention and mitigation measures. These partnerships that aim to prevent and mitigate risks to employees and the local communities provide further evidence of our industry's commitment to safety.

Public Safety COFFEYVILLE

Coffeyville Resources Nitrogen Fertilizers provides at least four days of training focused on ammonia handling and emergency response to external first responders every year. In March 2015, Coffeyville provided two days of training at the 4th annual Flammable Liquids and Foam Conference. Ongoing training throughout the year focuses on pumping operations, hazardous materials, rescue and tank fire response. Coffeyville's facility in Kansas is adjacent to a refinery, so the company also hosts joint training sessions with refinery personnel and community members.



Public Safety

LSB

LSB Chemical is committed to acting responsibly to assure the safety, health and environment for plant employees and neighbors. Both within and outside of the plant fence line, LSB facilities strive to maintain good working relationships with local emergency response organizations. These include law enforcement, fire/hazmat, emergency medical, and local emergency planning groups. The plants host information sharing sessions with these outside agencies to assure agency awareness of plant products and their characteristics. LSB plants also conduct joint drills with local responders to simulate an emergency situation and practice coordinated response between plant personnel and local first responders.

One recent plant drill held at LSB's El Dorado, Arkansas, facility included not only local emergency responders but also an air medical flight to transport "casualties" to an area hospital. A local high school drama department provided the simulated casualties who played their parts well and were "made up" right down to the simulated injuries. LSB will remain committed to this type of activity into the future, for the betterment of its facilities and the benefit of its neighbors and communities.

Responsible Ag

In recognition of the challenges, particularly for smaller retail companies, of navigating compliance with changing federal laws and regulations, TFI and the Agricultural Retailers Association (ARA) collaborated to create ResponsibleAg. Formed in 2014, this independent organization provides participating businesses a federal regulatory compliance assessment relating to the safe storage and handling of fertilizers, recommendations for corrective action where needed and a robust suite of resources to assist in this regard.

Participating facilities receive an assessment by a credentialed ResponsibleAg auditor once every three years. Up to 17 areas of a facility are assessed by the auditor. (Examples of these areas are dry fertilizer, liquid fertilizer, anhydrous ammonia, shop, office and grounds, etc.) The auditor will enter their findings into the secure portal on the ResponsibleAg website within 24 hours of completing the assessment. The facility will receive (if applicable) a corrective action plan listing any issues that were discovered by the auditor.

Knowledgeable auditors are the cornerstone of the ResponsibleAg initiative. In order to assure excellence

and consistency, all auditors are required to successfully complete a ResponsibleAg training course. Upon successful completion of the training course, any person can apply for certification as an auditor. ResponsibleAg will maintain an auditor credentialing application process. It will include a background check for purposes of confirming that the auditor applicant has not been convicted of a felony that is relevant to their performance as an auditor.

Education is a key component of ResponsibleAg's mission. If the auditor identifies compliance issues, the facility will receive a corrective action plan listing those issues, information on how to correct them and a recommended timeframe for corrections. Certification may not be obtained until all outstanding issues are addressed. Further, after appropriate notice, if the outstanding issues are not ultimately corrected, the facility will no longer be identified as participating in the program.



“We expect ResponsibleAg Certification to be recognized as an indication of safety and security, not just within the industry, but to the communities where our members operate,”

- Chris Jahn
President of The Fertilizer Institute

Facility registration began in December 2014. More than 1,850 fertilizer facilities registered from December 2014 through December 2015.

For more information, visit www.responsibleag.org.

SECTION THREE

Fertilizer Industry Operations



From raw materials mining, to fertilizer production, transportation, distribution and retail, TFI's membership spans the fertilizer industry value chain. Because the mining and production processes in the industry are the most resource-intensive, this section of the report focuses primarily on companies operating in these parts of the value chain.

Participants in this pilot project represent 49 percent of nitrogen production capacity and 75 percent of phosphate and potash production capacity in the United States⁵.

Energy

Energy is a necessary component in the process of creating fertilizer products. The energy metric in this report aims to capture energy consumption, energy intensity, and innovative or low-impact energy sourcing. The quantity of energy consumed is an important barometer when discussing environmental regulations that affect the cost of energy; it is also important when discussing natural gas policy. Some fertilizer manufacturers cogenerate energy or use other low-impact sources of energy (solar, steam from waste heat, for example), which reduce the overall energy footprint of the industry.

For the purposes of understanding the magnitude of energy consumed and types of energy used in the industry, energy consumption metrics from our member companies were assessed as part of this initial report. Participating companies provided data for direct and indirect energy use. For direct energy use, member companies either provided total fossil fuel consumption or the breakdown of fossil fuel consumption by fuel type (coal, fuel oil, gasoline, natural gas, propane, biogas/landfill gas and other natural gas use). For indirect energy use, member companies provided data for electricity use generated offsite, purchased steam use, and waste heat recaptured. The following charts show absolute and normalized energy usage. Eight TFI member companies provided energy usage data.

In 2014, the total energy use, direct and indirect, for participating member companies at U.S. operations was 105 million gigajoules (GJ), a slight increase from 103 million GJ in 2013. When normalized by nutrient tons of production, energy consumption in 2014 was 9.78 GJ per nutrient ton, compared with 9.74 GJ per nutrient ton in 2013.



Energy

THE MOSAIC COMPANY

The Mosaic Company's phosphate business unit uses cogeneration to satisfy nearly half of its electrical demand. In 2014, Mosaic's cogeneration produced approximately 5.8 million GJ of low-GHG emissions electricity, allowing the company to avoid approximately 1 million metric tons of CO₂-equivalent emissions.

Energy

COMPASS MINERALS

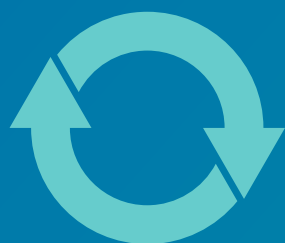
TFI member companies are committed to reducing energy usage or using renewable forms of energy in their operations to reduce environmental impacts. Compass Minerals uses solar energy to evaporate mineral-rich brine into a slurry that then gets processed into sulfate of potash, a premium plant nutrient for specialty crops and other minerals. By using solar energy instead of coal-fired evaporators, the company avoids 37 million tons of CO₂ emissions annually.



Natural gas is the primary feedstock for nitrogen production and also is an important source of energy for the production of other fertilizers. For the companies participating in this pilot program, natural gas as a feedstock amounted to about 91 million GJ in 2013 and 98.5 million GJ in 2014. The Haber-Bosch process is used for most all nitrogen production in the United States. It relies on separating the hydrogen from natural gas and combining it with inert nitrogen from the atmosphere. This changes the nitrogen to a form crops and other plants can use. These chemical processes are largely fixed so natural gas consumption for feedstock will rise and fall with the amount of fertilizer produced. For this reason, the natural gas used for feedstock is not reflected in the energy use charts on the opposite page.

Participating companies also reported capturing more than 108 million GJ of waste heat in 2014 and utilizing that thermal energy for heating and electricity generation. This represents energy that otherwise would have had to be supplied by fuel combustion or purchased.





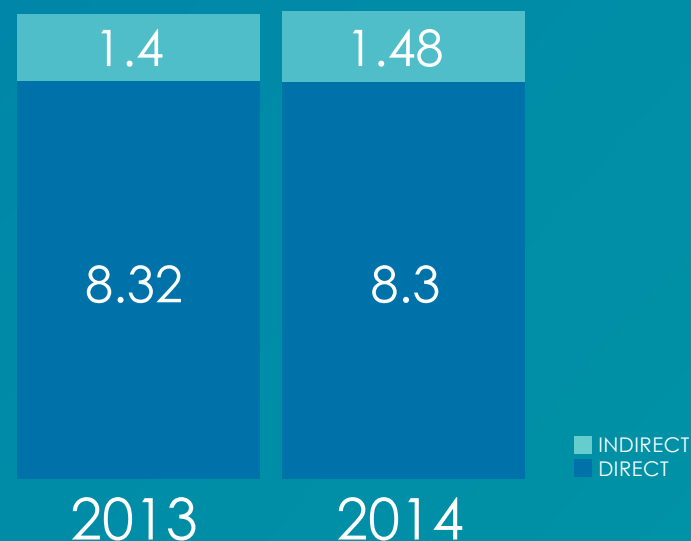
Waste Heat Recaptured **4% increase in 2014**

2013 = 102,832,810 GJ
2014 = 107,730,659 GJ

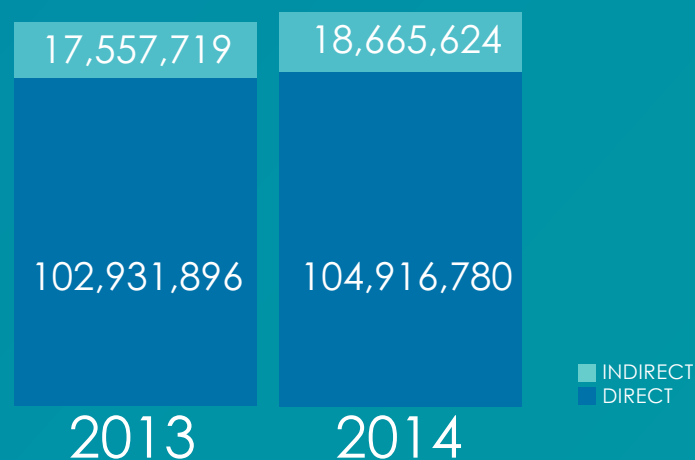
Total Energy Use **Increased only slightly in 2014**



Energy Use per Nutrient Ton Produced (in gigajoules per ton)



Total Energy Use (in gigajoules)



Greenhouse Gas Emissions

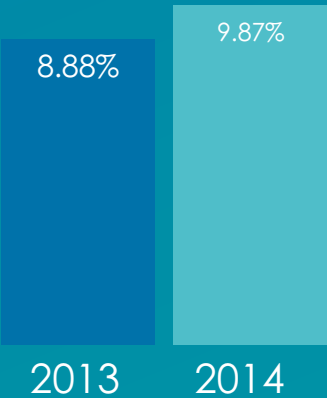
We recognize that air quality, and particularly greenhouse gas (GHG) emissions, is a significant issue that all industries must manage carefully. Climate change is an ever-greater part of the global conversation and GHG emissions are tied directly to the climate change discussion. While the fertilizer industry makes up a small portion of total U.S. GHG emissions, the industry is featured in many discussions as stakeholders across the food value chain engage in discussions to reduce GHG emissions.

Fertilizer producers emitting more than 25,000 tons (CO₂ equivalent) of GHGs are required to report total greenhouse gas emissions by facility to the U.S. Environmental Protection Agency Greenhouse Gas Reporting Program (GHGRP) by process unit and facility; this data is made publicly available on the EPA's website. However, this data only shows total emissions, and does not account for changes in production or improvements in efficiency.

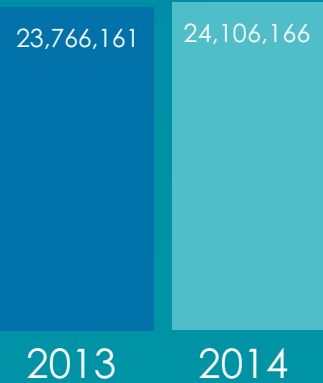
For the purposes of understanding the magnitude of GHG emissions for the industry, we have gathered GHG emissions metrics from our member companies for this initial report. Participating companies provided total GHG emissions as reported under GHGRP, separated by ammonia manufacturing, other nitrogen fertilizer, and phosphate/potash production and manufacturing. The emissions were optionally separated by emissions generated from combustion processes and from production. Lastly, companies reported the percentage of CO₂ that was captured and not emitted, which is not explicitly broken out under the GHGRP data. The captured CO₂ is used in the production of urea and for other industrial operations. The following charts show absolute and normalized energy use per nutrient ton produced. Eight TFI member companies provided GHG emissions data; however, since in some categories fewer than three companies reported, we are showing total GHG emissions for the participating companies without further breakdowns of the data in this pilot report.

Greenhouse Gas Emissions

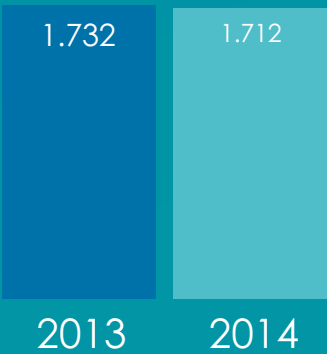
CO₂ captured



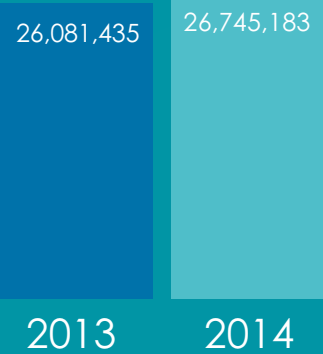
GHGs emitted
(in tons CO₂e - carbon captured)



GHG emissions
per nutrient ton



Total GHG emissions
(in ton CO₂e)



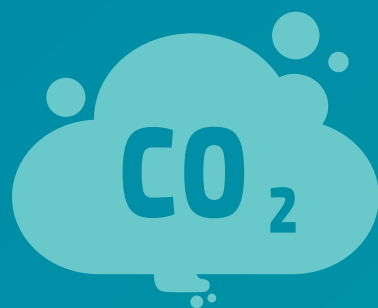


CO₂ captured

2013 = 8.88%

2014 = 9.87%

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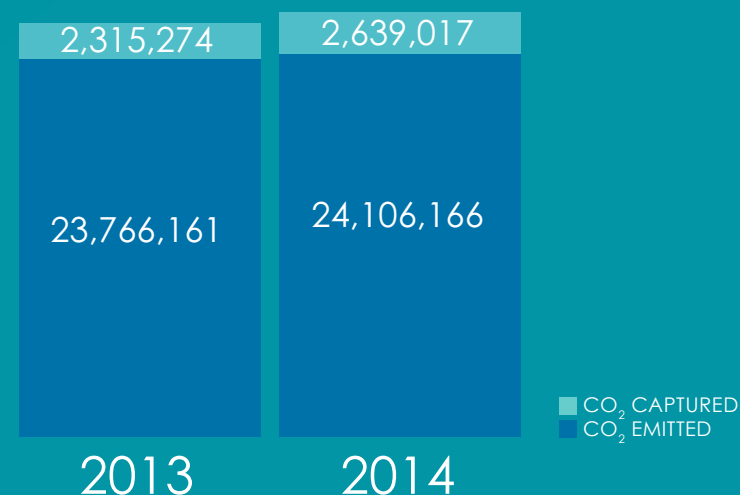
Total GHG
emissions
reported

**2013 =
26,081,435**
tons CO₂e

**2014 =
26,745,183**
tons CO₂e

By capturing GHG emissions intensity, the industry will be able to quantify emission efficiency improvements. As new nitrogen facilities become operational, net GHG emissions due to fertilizer production are expected to increase in absolute terms (relative to the increase in fertilizer output). However, at the same time, efficiency will increase and overall GHG emission intensity will decrease.

Total GHG Emissions
(in tons of CO₂ equivalent)



Reclamation

THE MOSAIC COMPANY

In Mosaic's phosphate mining operations, the company restores or reclaims every acre of land mined, with certain areas of high environmental sensitivity set aside for preservation and protected into perpetuity with recorded conservation easements. Mined lands are reclaimed to land uses such as wildlife habitat (both wetlands and upland) and agricultural lands. Much of this land is also suitable for future conventional development such as parks, housing and commercial use. The Mosaic Company reclaimed approximately 6,000 ⁶ acres and planted more than two million trees in 2014, reclaiming uplands, significant upland habitats, and wetlands that require, at a minimum, acre-for-acre and type-for-type reclamation per permitting requirements.

Land Conservation and Rehabilitation

Fertilizer production can have a very large physical footprint, especially in the mining sector. However, every surface acre mined is reclaimed, making such lands available for productive uses for both wildlife and people. The land use metric is aimed at capturing how many acres of habitat or wetland the fertilizer industry has reclaimed or improved. This metric, while primarily focused on mine reclamation, is applicable to any fertilizer producer who has disturbed and/or reclaimed land around their facilities. Participating companies were asked to provide the number of acres reclaimed or restored during 2013 or 2014 related to fertilizer operations in the United States. Fewer than three companies provided data for this metric, so an aggregated total is not available in this pilot report.





Water

Water is of great importance in the production of phosphate and potash, and to a lesser extent, nitrogen fertilizers. While fertilizer operations can be water intensive, industry members are improving water efficiency and conservation by reusing or recycling water in their operations. There is evidence that the amount of water reuse in phosphate and potash production is very high as a percent of overall water use. Additionally, many regulatory changes designed to affect either waste management or air emissions can also affect water reuse. By quantifying the amount of reused water, the industry will be better able to demonstrate the impacts of these tangential regulatory changes.

For the purposes of understanding the magnitude of water consumed and reused by our industry, we gathered water-related data from member companies as part of this initial reporting effort. Participating companies provided the volume (in gallons) for purchased water, water withdrawn from wells, surface water withdrawn, collected rainwater, reclaimed water from off site, and reused or recycled water. The following charts show absolute and normalized water usage. Seven TFI member companies provided water usage data with corresponding production data; these members represent 53 percent of total nutrient production capacity in the United States.

Preserving a Community's Drinking Water

KOCH FERTILIZER

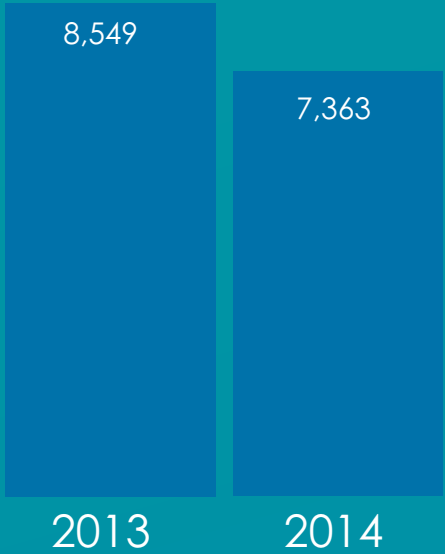
TFI member companies are working to reduce water usage or reuse alternate sources of water in their fertilizer production operations. As part of a fertilizer plant expansion, Koch Fertilizer in Enid, Okla. will be shifting its water supply from the City of Enid's potable water to the city's treated wastewater effluent. To enable this water supply switch, Koch worked with the City of Enid to construct a water pipeline to transport the water from the city's wastewater treatment plant to the Koch fertilizer production facility. Koch Fertilizer also constructed a new water treatment facility that will reduce the fertilizer plant's dependence on the Enid's drinking water by up to five million gallons per day.

Reducing Water Consumption

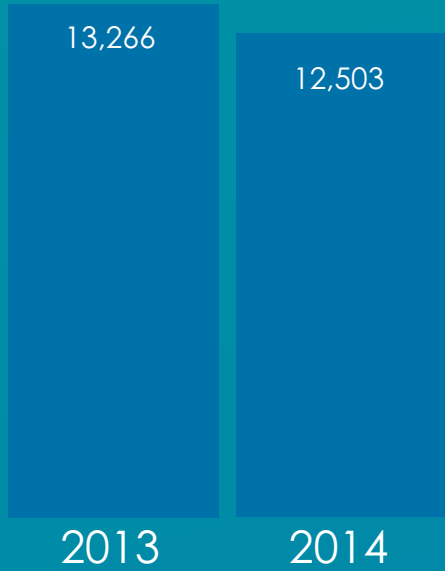
COMPASS MINERALS

Compass Minerals new pond-sealing technology to create a pond barrier to reduce overall water consumption in the company's solar pond operations. The pond-sealing technology developed by Compass Minerals engineers allows the company to reduce brine loss and retain more of the most concentrated brine for evaporation. In retaining the brine more effectively in the ponds, less water volume is exposed to enhanced evaporation, and thereby reduces overall water consumption in solar pond operations. Quantification of the full benefits of the technology is ongoing, but the company expects to achieve greater than 25 percent water conservation.

Total water use per ton N produced
(in gallons per ton)



Total water use per ton P + K produced
(in gallons per ton)

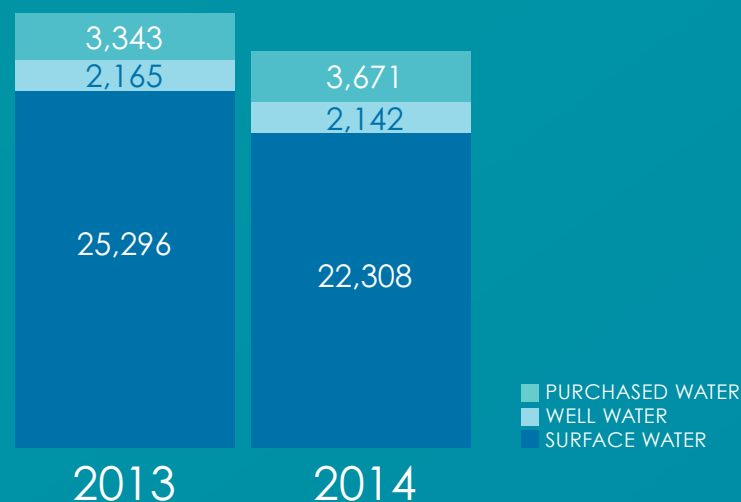


Reporting companies recycle surface and groundwater and reuse this finite resource on average, more than four times during the production process.

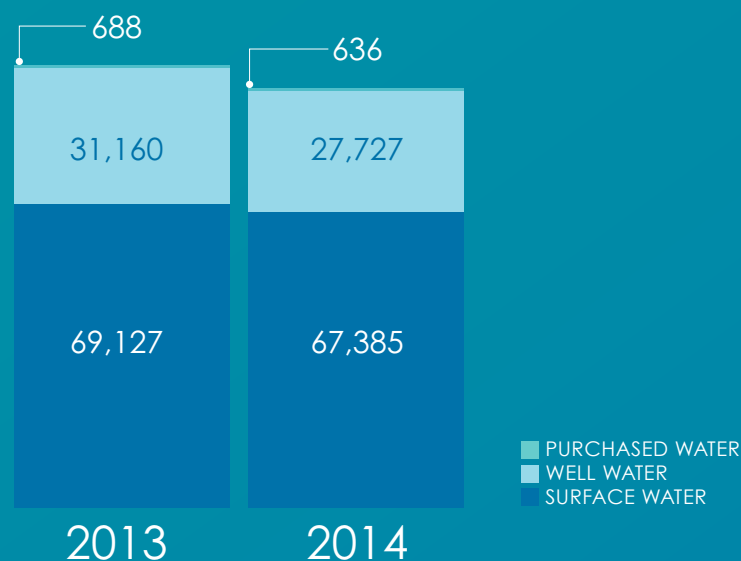
Total Water Usage
**decreased by
13% in 2014**



Water Use - Nitrogen Producers
(in million gallons)



Water Use - Phosphate & Potash Producers
(in million gallons)





SECTION FOUR

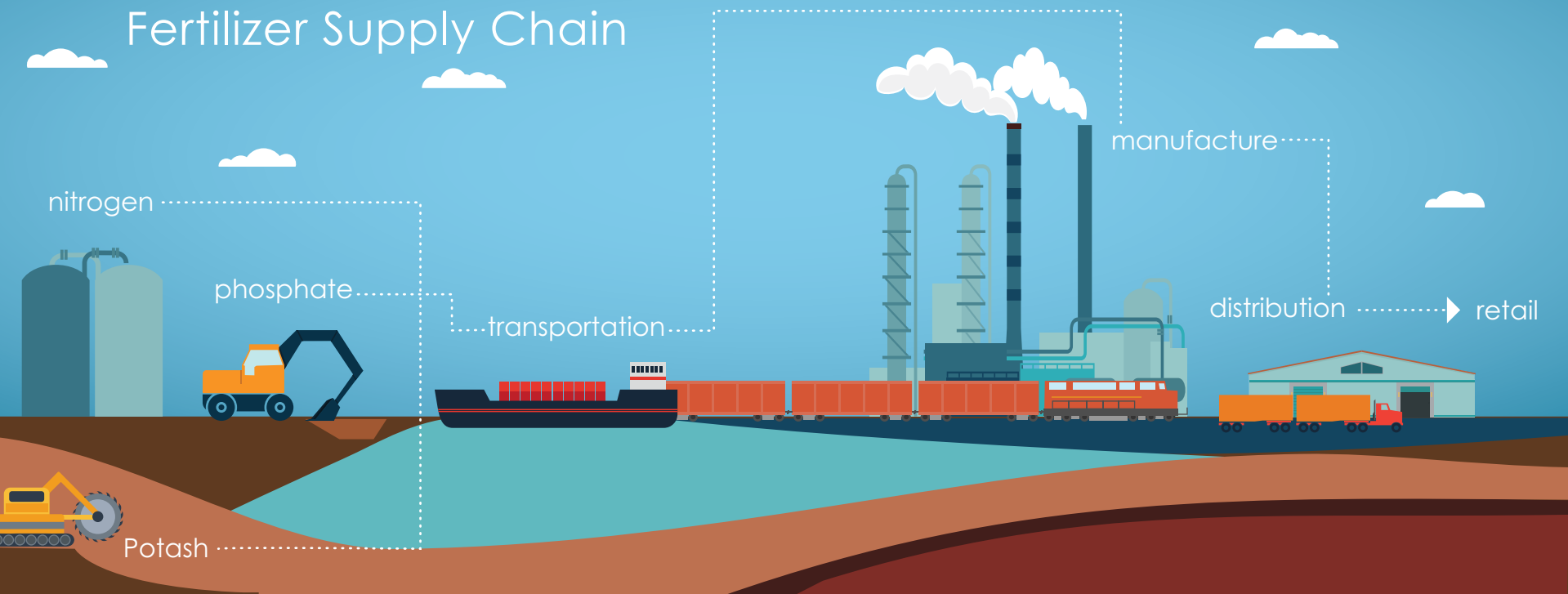
Fertilizer Transportation



Fertilizer is transported on a year-round basis, and it is important for everyone in the fertilizer value chain that transportation capacity is sufficient for these important products. Because the sources of fertilizer raw components are located only in specific areas and the end products are required all across the world for agricultural production, the distribution logistics and transportation of fertilizer is a global process. Fertilizers are transported within the United States by truck and rail, through pipelines and by barges on the nation's river system.

The success of the fertilizer supply chain, and in turn U.S. food production, hinges on reliable and available transportation. Disruptions in the transportation network can impact each link in the system – from manufacturers to the industry's farmer customers. Fertilizer transportation capacity ultimately affects prices consumers pay for food, fuel and fiber.

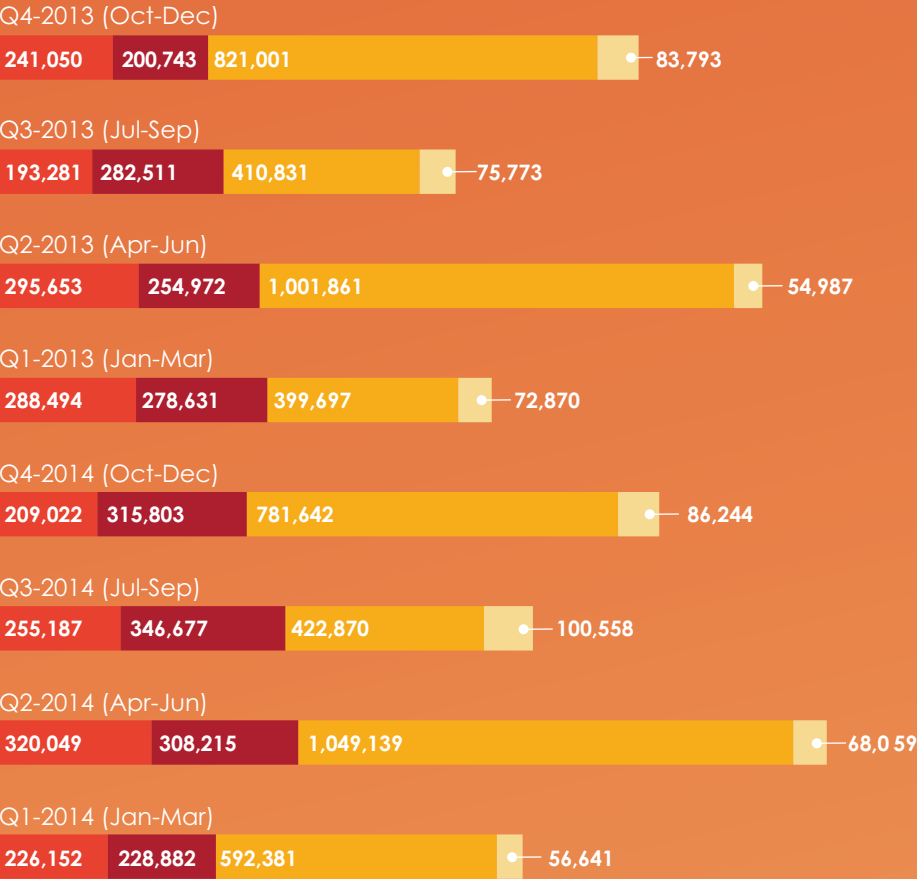
Fertilizer Supply Chain



For the purposes of understanding the magnitude of the industry's transportation footprint, we have gathered transportation metrics from TFI member companies as part of this initial report. Participating companies provided the amount of material transported (in short tons) by quarter via barge, rail, truck or other transportation mechanisms. Other transportation can include pipeline, title transfers, vessel deliveries or transport of other products. The included charts show transport of anhydrous ammonia, ammonium nitrate, other nitrogen fertilizer materials, potassium fertilizers, phosphatic fertilizers and other NPK (blended) fertilizers. Eight TFI member companies provided data for the transportation metric.

Participants in this project represent 34 percent of nitrogen production capacity and 52 percent of phosphate and potash production capacity in the United States.

Anhydrous Ammonia (tons material transported)



Barge



Rail

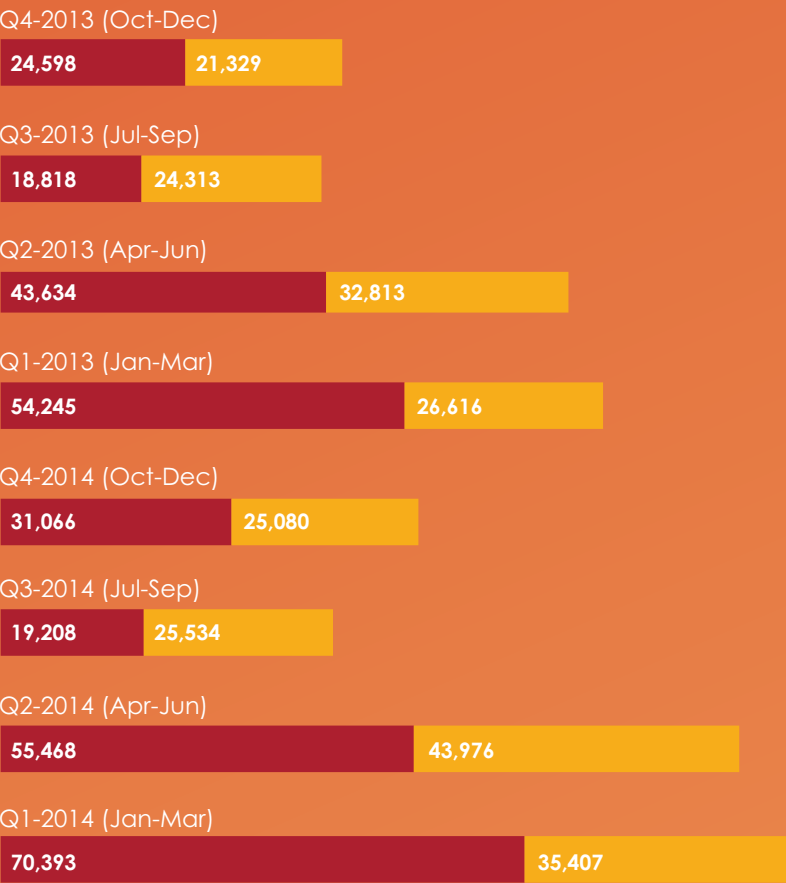


Truck

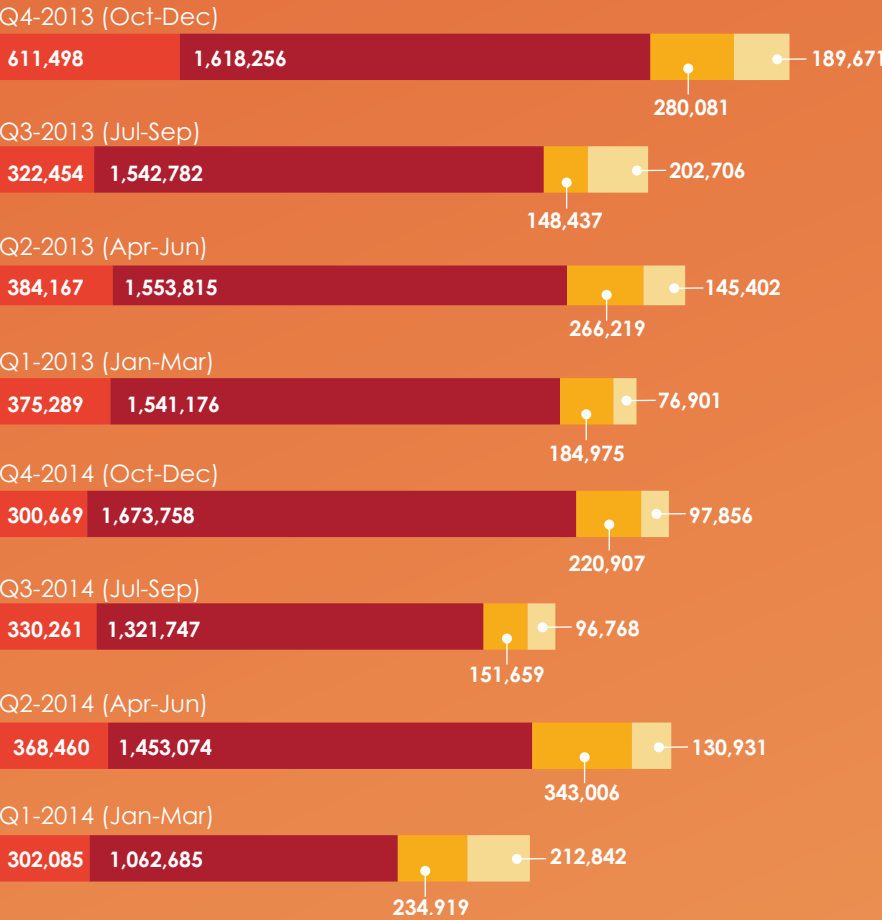


Other

Ammonium Nitrate (tons material transported)

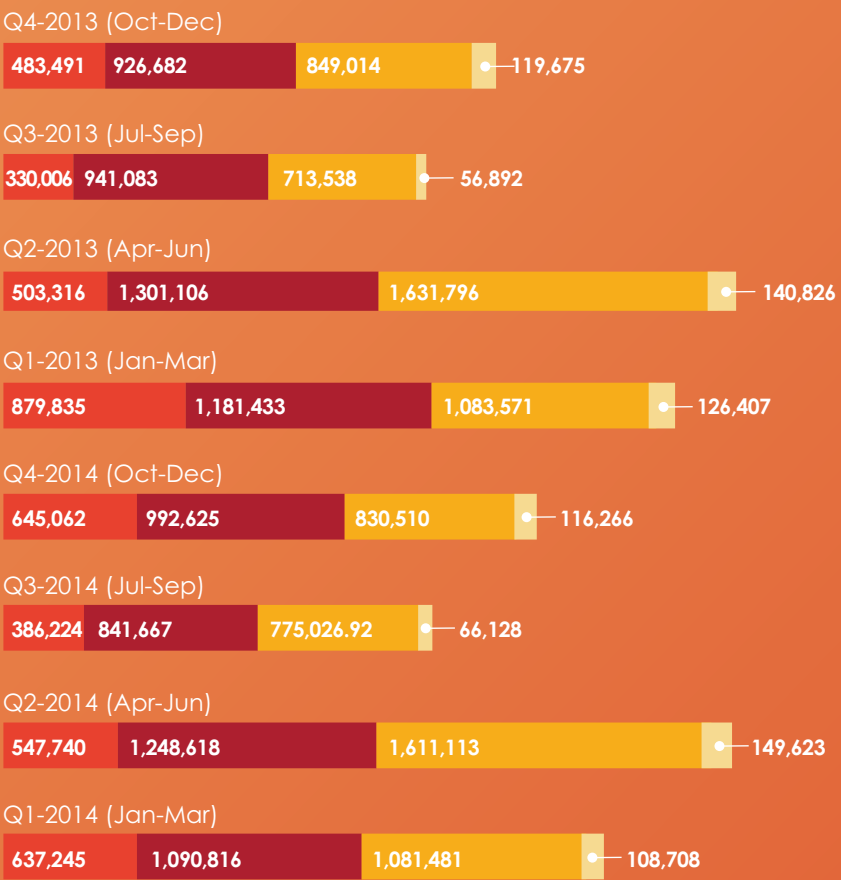


Potassium Fertilizers (tons material transported)



Phosphatic Fertilizers (tons material transported)

Other Nitrogen Fertilizer Materials (tons material transported)



Barge



Rail

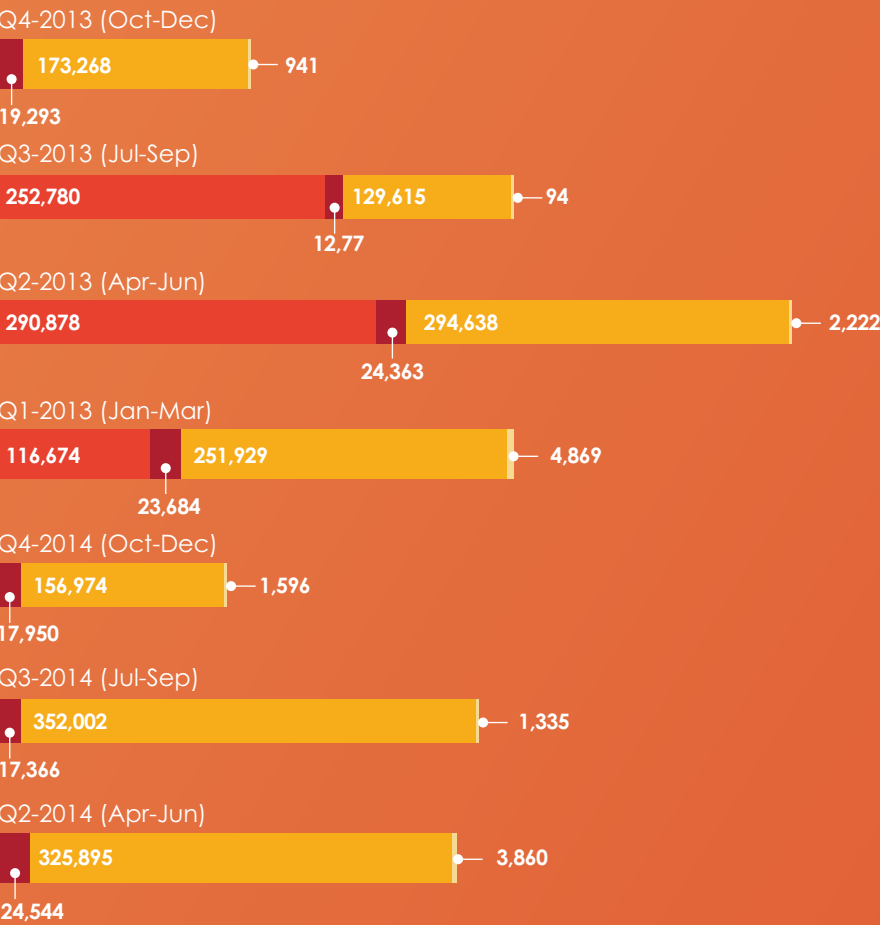


Truck



Other

Other NPK Fertilizers
(tons material transported)



SECTION FIVE

Enabling Nutrient Stewardship



4R Initiative

For fertilizer use to be sustainable, it must support cropping systems that provide economic, social and environmental benefits. Poorly managed nutrient applications can increase nutrient losses, potentially degrading soils, water and air and, in turn, decrease farmer profitability. The 4R nutrient stewardship system, adopted by the industry, is an innovative and science-based approach that offers enhanced environmental protection, increased production, increased farmer profitability, and improved sustainability. This framework is site and crop-specific and involves use of the right fertilizer source, at the right rate, at the right time, with the right placement.

Innovative Farmer and Retailer Work Together on 4R Implementation in the Chesapeake Bay Watershed

Sean Jones is the principal manager of a diverse 1,500 acre family farming operation in Massey, Maryland. Working with Mike Twining at Willard Agri-Service, a family-owned retail agribusiness, Sean makes decisions based on the 4Rs to ensure proper nutrient application to address crop production goals, efficient use of inputs, and reduced nutrient losses to help protect the Chesapeake Bay watershed.

More than 1,000 acres of the Jones' 1,500 acres of grain and forage production are irrigated. The crops grown on these acres help meet the nutritional needs of more than 1,200 dairy cows and 1,400 heifers, dry cows and calves. In turn these dairy cattle contribute to the farm's crop nutrient needs. The operation uses a four-stage lagoon system for storing and applying manure to crops through the operation's irrigation system (fertigation).

Sean and Mike work as a team to conduct extensive nutrient management planning supported by a geographic information system (GIS)-based record keeping system and crop analysis through Willard's HighQ Decision Support System. By using a customized suite of practices, such as in-season fertilizer applications, plant tissue testing, nitrogen stabilizers and cover crops along with meticulous planning and partnership, Jones says, "We're getting the nutrients where they're needed."

For more details on these 4R Advocates and this farming operation, visit nutrientstewardship.org.

Implications of farmer adoption of the 4R nutrient stewardship system spread far and wide through agriculture and society as a whole. The 4R nutrient stewardship principles are the same globally, but how they are used locally varies depending on field and numerous variables including soil, cropping system, management techniques and climate.

TFI member companies support nutrient stewardship in many ways through: research, professional consultations with farmers, and developing new products that make fertilizer use even more effective.



The Scientific Principles of The 4R Framework Include:



Right Source

Ensure a balanced supply of essential nutrients, considering both naturally available sources and the characteristics of specific products, in plant available forms.



Right Rate

Assess and make decisions based on soil nutrient supply and plant demand.



Right Time

Assess and make decisions based on the dynamics of crop uptake, soil supply, nutrient loss risks, and field operation logistics.



Right Place

Address root-soil dynamics and nutrient movement, and manage spatial variability within the field to meet site-specific crop needs and limit potential losses from the field.



Role of the Agronomic Professional

To stay on the leading edge of crop science and to assist farmers in making the best decisions about how, what, where, when and in what amounts to apply nutrients to their land, agronomic professionals are an important part of the industry. Many fertilizer producers and retailers in the United States employ Certified Crop Advisers (CCAs) to assist farmers in analyzing their land, crop health and yields to make well-informed choices about their use of and investment in their fertilizers. Whether through creating custom blends of bulk fertilizers or through precision agriculture techniques of soil analysis and crop mapping, CCAs play a valuable role as a resource to farmers. Because these professionals have met rigorous industry standards through the American Society of Agronomy's certification program, they are equipped to apply leading edge technical knowledge to farmers' inquiries and help ensure their land will yield the appropriate volumes and quality of crops.

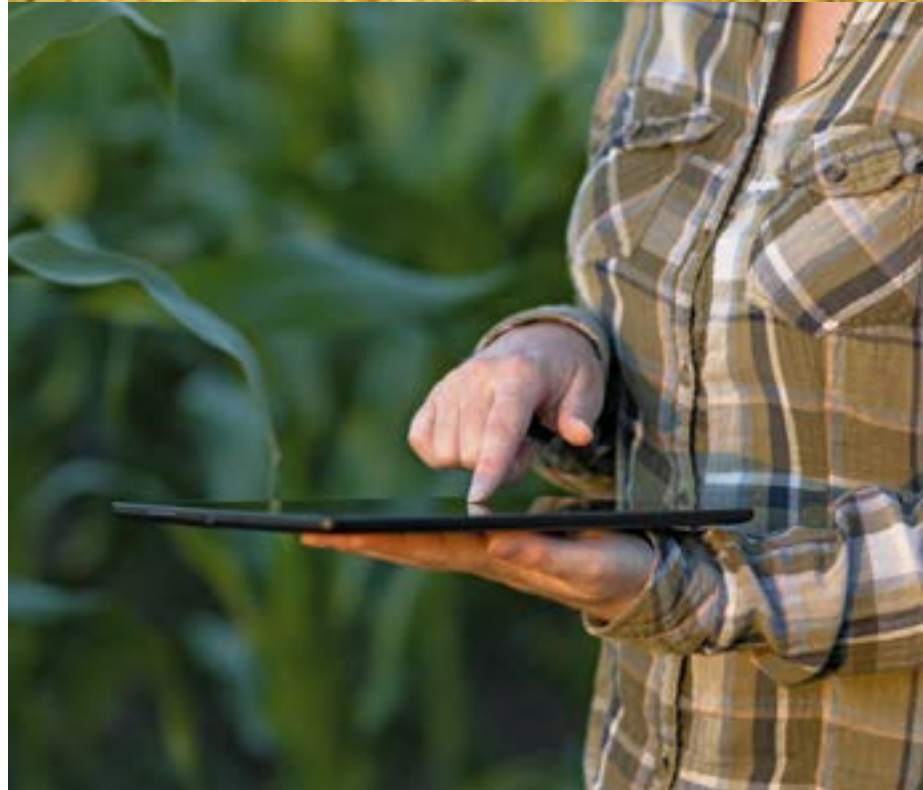
Companies participating in this pilot project reported employing a total of 2,730 professionals during 2014 with agronomic responsibilities as part of their regular job duties, of whom 630 held certifications as either CCAs or Certified Professional Agronomists. This was an increase from 2013, when 2,720 agronomic professionals were reported (of whom 579 held certifications).

4R Research

In 2013, the 4R Research Fund was established by the fertilizer industry to help establish sustainability indicators and environmental impact data for implementation of 4R nutrient stewardship across North America. It provides needed resource support with a focus on measuring and documenting the economic, social and environmental impacts of 4R nutrient stewardship. The 4R Research Fund is helping the 4Rs become a viable and widely accepted framework to address cropping system productivity and concerns for nutrient losses into the environment.

Following two 2013 requests for proposals, \$2,434,482 was awarded for nine projects in the United States. \$508,000 were awarded to support a series of 11 projects in Canada. Information about projects awarded in 2014 is available online (http://research.ipni.net/toc/category/4r_research_fund).

Funds for the 4R research effort were initially derived from within the fertilizer industry. Specifically, The Fertilizer Institute (TFI) and Fertilizer Canada (FC) have obtained support from their members. And, since creation, additional agricultural stakeholders have contributed to the effort. The 4R Research Fund has been established within the Foundation for Agronomic Research (FAR), which is a non-profit 501(c) (3) research and education foundation that is managed by the International Plant Nutrition Institute (IPNI).



A Technical Advisory Group comprised of representatives from industry, academia and government agencies serves in an advisory capacity regarding research needs and priority funding areas. Disciplines represented on the committee include experts in agronomy, environmental sciences, sustainability, government relations and communications. A 4R Fund Management Committee provides financial and project oversight of the 4R Research Fund. This committee includes representation from IPNI, TFI and FC, as well as agricultural industry members.

During 2013, the North American fertilizer industry contributed \$1,158,300 to the 4R research effort. In 2014, \$1,373,138 was contributed. These funds represent the first two years of an initial five-year commitment by members of TFI and FC.



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During 2013 and 2014, the
North American fertilizer industry
contributed a
combined total of
\$2,531,438
to the 4R research effort.

Nutrient Stewardship

KOCH

Koch maintains partnerships with a variety of land-grant universities and the U.S. Department of Agriculture's Agricultural Research Service to support nutrient stewardship. The company funded approximately 70 research projects in total during 2013 and 2014. These projects were designed to demonstrate how nitrogen stabilizers can be used by farmers to prevent loss and improve fertilizer efficiency. Scientists and extension specialists are encouraged to publish their results in peer-reviewed journals, extension bulletins and websites so their results can be quickly available to producers and crop advisors. In addition, the business uses the results to demonstrate nutrient stewardship concepts in customer and internal training sessions.

4R Partnerships

The Fertilizer Institute and members of the fertilizer industry engage with non-governmental organizations and research groups on various aspects of our industry. Nutrient stewardship and land quality protection are two important topics on which we regularly interact with scientists, community members, customers and others to better understand their issues.

Nutrient Stewardship

THE FERTILIZER INSTITUTE

The Fertilizer Institute engages and supports multiple stakeholder organizations who are valuable partners in 4R Nutrient Stewardship outreach and implementation. An example is TFI's efforts with the Conservation Technology Information Center (CTIC). CTIC champions, promotes and provides information on technologies and sustainable agricultural systems. Beyond serving on CTIC's Board of Directors, TFI provides monetary and in-kind support for watershed projects, educational programs and their annual Conservation in Action Tour.



Nutrient Stewardship CF INDUSTRIES

CF Industries supports the National FFA Organization to educate future farmers in 4R practices. CF Industries recently made a \$600,000 donation to the National FFA Organization from the net proceeds of selling carbon reduction credits to Chevrolet's Carbon Reduction Initiative. The credits were generated by voluntarily implementing nitrous oxide abatement technologies to reduce greenhouse gas emissions.

Nutrient Stewardship SQM NORTH AMERICA

SQM North America partners with leading universities — North Carolina State University, Clemson University, University of Vermont, Colorado State University, Oregon State University — to run trial studies on efficient nutrient use and yield improvement. This total investment of around \$500,000 in recent and ongoing trials has provided numerous data points helping improve the use of fertilizer across numerous crops throughout the U.S.

NOTES

- 1 The information provided herein is on an "as is" basis. TFI (including its Officers, directors, employees and member companies) accepts no responsibility for any inaccuracies, does not make any warranty or representation, either express or implied, regarding its accuracy, completeness, or utility; nor does TFI (including its Officers, directors, employees and member companies) assume any liability of any kind whatsoever resulting from the use or reliance upon, any information, material, or procedure contained herein, including but not limited to any claims for damages, loss or injury regarding health, safety, or environmental effects.
- 2 International Fertilizer Industry Association, *Processed Phosphate Statistics Report*
- 3 John Dunham and Associates, Inc. *Economic Contribution of the U.S. Fertilizer Industry, 2015*
- 4 John Dunham and Associates, Inc. *Economic Contribution of the U.S. Fertilizer Industry, 2015*
- 5 Calculated using participants U.S. production capacity as reported for the year ending June 30, 2014 in the September 2015 North American Fertilizer Capacity Report prepared by the International Fertilizer Development Center.
- 6 As of the date of this publication's release, this figure has not been validated by the Florida Department of Environmental Protection. Accordingly, these figures are an estimate and may be revised in Mosaic's own publicly available sustainability report.



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