

Corporate Social Responsibility (CSR)

Contributing to Sustainability through Gas Technologies

With the aim of contributing to sustainability, the Taiyo Nippon Sanso Group works to ensure a solid grasp of its impact on the global environment of all of its business activities. Through gas technologies that make use of the earth's bounty, the Group also strives to help realize an enduring society that enjoys both spiritual and material wealth.



Basic Approach

- [Environmental and Social Contribution across the Value Chain \(P. 2\)](#)
- [Principal Challenges and Initiatives \(P. 3\)](#)



Social Contribution Initiatives

- [Initiatives to Ensure Safe and Stable Supplies \(P. 7\)](#)
- [Making Use of Intellectual Property \(P. 9\)](#)
- [Relations with Customers \(P. 10\)](#)
- [Relations with Employees: Cultivating Human Resources/Internal Communications/Work Style Reforms/Health Management \(P. 14\)](#)
- [Relations with Suppliers \(P. 23\)](#)
- [Relations with Shareholders and Investors \(P. 24\)](#)
- [Relations with Local Communities \(P. 26\)](#)
- [Non-Financial Data \(P. 30\)](#)

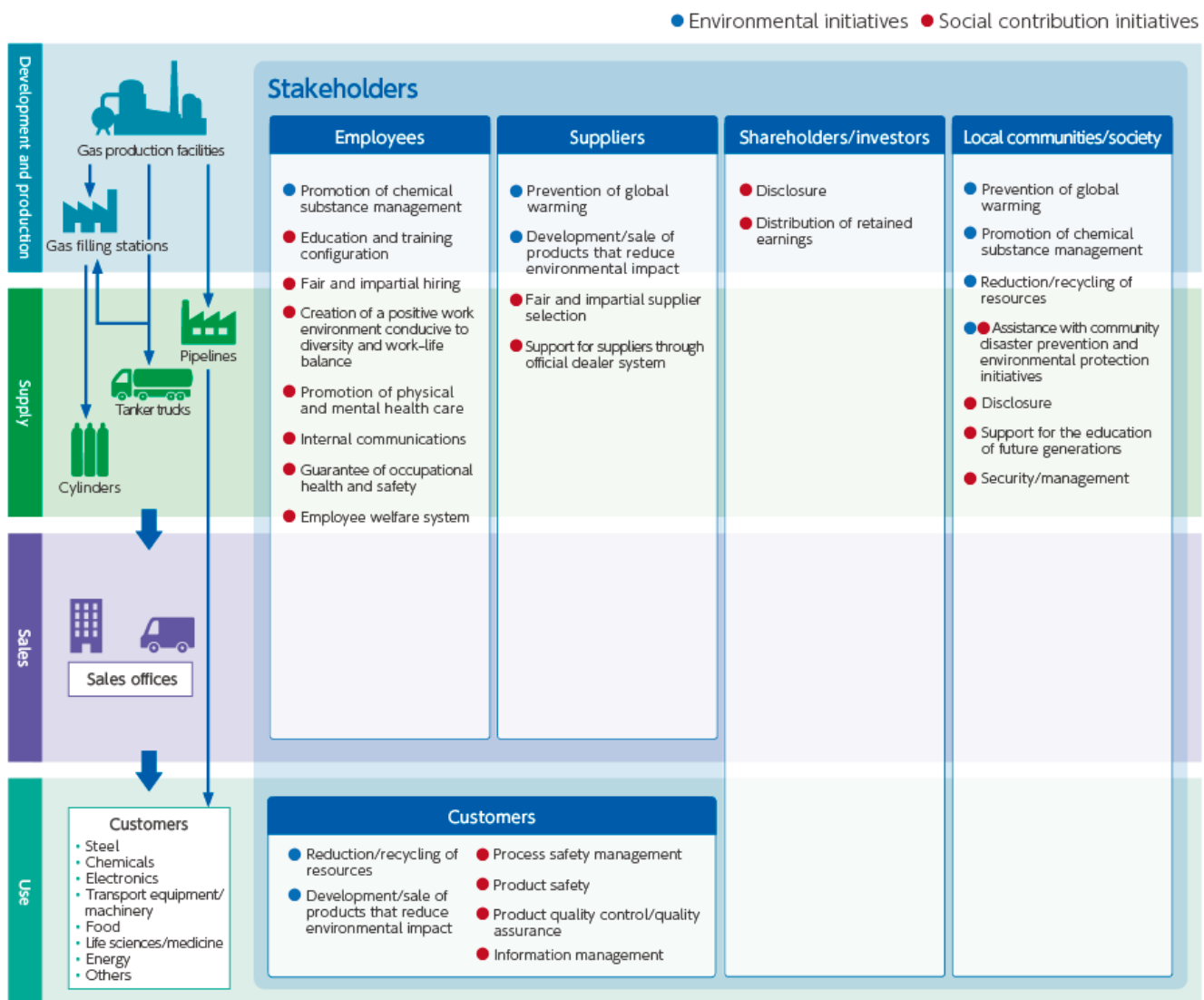


Environmental Initiatives

- [Environmental Management \(P. 39\)](#)
- [Protecting the Environment \(P. 41\)](#)
- [Environmental Data \(P. 45\)](#)
- [Developing Environment-Friendly Products \(P. 50\)](#)

Environmental and Social Contribution across the Value Chain

We work to ensure a solid grasp of our environmental and social impact on stakeholders through all of our business processes—from development and production through to supply, sale and use, that is, across our entire value chain—and implement a variety of initiatives designed to avoid or mitigate related risks. Looking ahead, we will also strive to contribute to a sustainable society by reinforcing collaboration not only with Group companies but with all stakeholders.








Principal Challenges and Initiatives


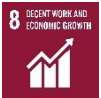


As a member of the Mitsubishi Chemical Holdings Group, we promote a variety of environmental and social contribution initiatives based on Management of Sustainability (MOS), a proprietary Mitsubishi Chemical Holdings Group management method founded on the concept of management that advances sustainability.

The Taiyo Nippon Sanso Group's ESG Initiatives

The Mitsubishi Chemical Holdings Group uses account processes set forth in globally recognized sustainability guidelines and stakeholder perspectives to identify key, i.e., material, issues facing the Group, as well as to prioritize such issues, that is, conduct materiality assessments. We have identified those that are of material importance to the Taiyo Nippon Sanso Group, taking into account the unique characteristics of its businesses, as well as its impact on the environment and society. We are also promoting a variety of initiatives with the aim of contributing to the achievement of the Sustainable Development Goals (SDGs) for 2030, which were adopted at the United Nations' Sustainable Development Summit in September 2015.

	Material issues	Role of the Taiyo Nippon Sanso Group	Principal initiatives in fiscal year 2019	Pertinent SDGs
Management issues	Compliance	<ul style="list-style-type: none"> In adherence to high ethical standards, strive to conduct corporate activities in a fair, impartial and sincere manner by promoting and maintaining compliance with relevant laws, regulations, international norms and internal rules. 	See 2019 Integrated Report	
	Corporate governance	<ul style="list-style-type: none"> Reinforce corporate governance by improving management transparency and fairness, as well as by increasing management agility through efforts to enhance management oversight functions and accelerate decision making. 		
	Process safety	<ul style="list-style-type: none"> Strengthen independent systems for ensuring process safety in line with our belief that selling gases is commensurate with selling safety. 	<ul style="list-style-type: none"> Initiatives to ensure safe and stable supplies Relations with customers 	

	Material issues	Role of the Taiyo Nippon Sanso Group	Principal initiatives in fiscal year 2019	Pertinent SDGs
Global environment	Efficient use of resources and energy	<ul style="list-style-type: none"> Introduce effective air separation units that help reduce electric power consumption and CO2 emissions. Lower fuel consumption by tanker trucks to reduce related CO2 emissions. 	<ul style="list-style-type: none"> Environmental management Initiatives to protect the global environment Environmental data 	 <p>Ensure access to affordable, reliable, sustainable and modern energy for all</p>
	Climate change	<ul style="list-style-type: none"> Fortify framework for mitigating climate change through the reduction of greenhouse gas emissions and other efforts. Promote the reduction of greenhouse gas emissions and the creation and expansion of opportunities to mitigate/adapt to climate change through the sale of vacuum-insulated bottles and cookware. 		 <p>Ensure sustainable consumption and production patterns</p>  <p>Take urgent action to combat climate change and its impacts</p>
Society	Contribution to maintenance of physical health Contribution to medical care	<ul style="list-style-type: none"> Contribute to health and medical care through the provision of products for the medical field. 	See 2019 Integrated Report	 <p>Ensure healthy lives and promote well-being for all at all ages</p>
	Response to food and agriculture-related issues	<ul style="list-style-type: none"> Provide industrial gases and related equipment that help resolve key issues by helping protect food resources and improve agricultural productivity. 	<ul style="list-style-type: none"> Developing environment-friendly products <p>See 2019 Integrated Report</p>	 <p>Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation</p>
	Increase in consumer satisfaction	<ul style="list-style-type: none"> Leverage the advantages of LPG, including its low carbon footprint and the disaster-resistant nature of its distribution system, to create business opportunities and expand business. Contribute to the realization of comfortable and environment-friendly lifestyles through the sale of Thermos-brand products. 		

	Material issues	Role of the Taiyo Nippon Sanso Group	Principal initiatives in fiscal year 2019	Pertinent SDGs
People (Taiyo Nippon Sanso and its organizational structure)	Product and service reliability	<ul style="list-style-type: none"> Ensure that customers can use products with peace of mind by strengthening systems to ensure quality and safety across the entire product life cycle. 	<ul style="list-style-type: none"> Initiatives to ensure safe and stable supplies Relations with customers Developing environment-friendly products 	 Ensure healthy lives and promote well-being for all at all ages
	Human development and training	<ul style="list-style-type: none"> Offer equal opportunities in hiring, placement, advancement and skill development as well as seek to foster and develop human resources from medium- and long-term perspectives. 	<ul style="list-style-type: none"> Relations with employees 	 Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
	Occupational health and safety	<ul style="list-style-type: none"> Promote health management in accordance with relevant national and regional laws and regulations, create safe work environments while at the same time maintaining and advancing the physical and mental health of employees. 		 Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
	Respect for human rights	<ul style="list-style-type: none"> Respect human rights in corporate activities and require that business partners do not violate human rights or engage in any form of discriminatory behavior (through such measures as the promotion of anti-harassment initiatives and the establishment of hotlines). 		
	Promotion of measures to improve information security and privacy	<ul style="list-style-type: none"> Recognize the importance of and responsibilities associated with protecting information assets in corporate activities and ensure appropriate information management to prevent leaks of confidential information pertaining to customers, business partners, Taiyo Nippon Sanso and other parties. 	<ul style="list-style-type: none"> Relations with customers 	 Ensure sustainable consumption and production patterns
	Diversity and inclusion	<ul style="list-style-type: none"> Actively seek to secure diverse human resources with diverse values without regard to considerations such as nationality, age or creed and promote diversity and inclusion in corporate activities. (Examples: Advance career opportunities for female employees, expand hiring of foreign nationals, promote the hiring of individuals with disabilities) 	<ul style="list-style-type: none"> Relations with employees 	

	Contribution to communities	<ul style="list-style-type: none"> • Step up efforts to contribute to society through business activities and deepen understanding of communities while at the same time working continuously to respond to communities' requests and expectations. 	<ul style="list-style-type: none"> • Relations with local communities 	
	Stakeholder engagement	<ul style="list-style-type: none"> • Earn stakeholders' trust through respect and close dialogue and by reflecting their views in corporate activities, and work with stakeholders to realize a better society. 	<ul style="list-style-type: none"> • Relations with employees • Relations with suppliers • Relations with shareholders • Relations with local communities 	

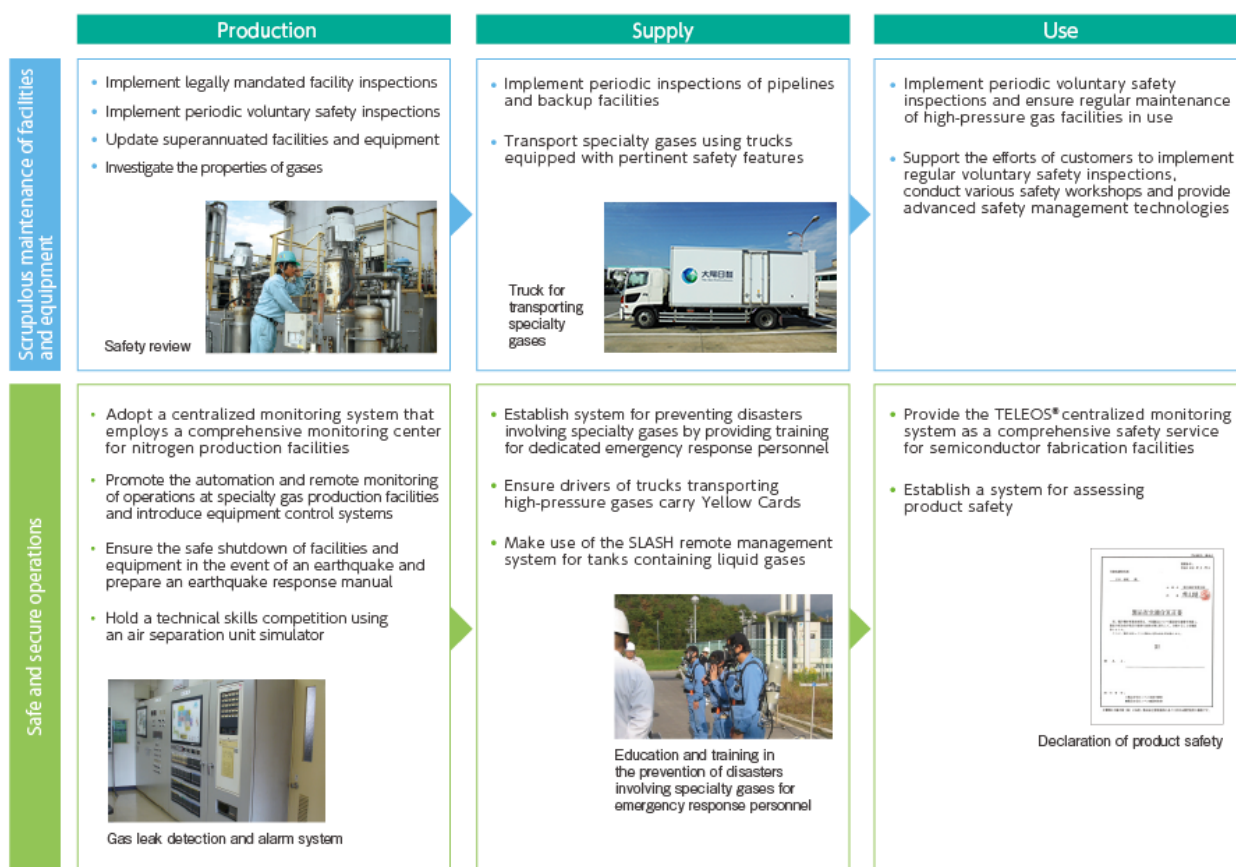
Initiatives to Ensure Safe and Stable Supplies

As “The Gas Professionals,” we work to provide safe and stable supplies of industrial gases to customers in a wide range of industries.

Strengthening Framework for Ensuring Safe and Stable Supplies

We deliver gases to customers in a broad range of industries using various modes of transport depending on the characteristics of the gases themselves and the needs of the customer. To ensure safe and stable supplies, we are stepping up efforts at all Taiyo Nippon Sanso Group production and supply facilities, as well as at the facilities of our official dealers (“partner companies”) and at our customers’ premises, to strengthen our capabilities at the production, supply and use stages. We are also working to enhance process safety at Taiyo Nippon Sanso Group sites in Japan and overseas, including in the United States and Europe. In Asia and Oceania, in particular, we are taking steps to correct unsafe processes identified through the implementation of voluntary safety reviews.

Ensuring Safe and Stable Supplies



- Conduct disaster and high-pressure gas leak response drills
- Introduce a commendation system to recognize the results of independent safety initiatives



Disaster drill

- Develop a database to facilitate the sharing of information pertaining to accidents and safety issues
- Provide periodic workshops aimed at personnel involved in the transport of specialty gases
- Encourage the acquisition of Japan's high-pressure gas transport monitor qualification and completion of training for transport personnel offered by the High-Pressure Gas Safety Institute of Japan
- Hold quality and safety promotion conferences for tanker truck transport companies across Japan and traffic safety training



Traffic safety training

- Conduct high-pressure gas safety workshops
- Promote the sharing of product safety data sheets and information pertaining to product safety and security



Safety workshop for customers

Competition Using an Air Separation Unit Simulator to Improve Operators' Technical Capabilities

The stable, efficient production of industrial gases depends on the outstanding technical skills of air separation unit operators. We stage an annual competition using an air separation unit simulator to showcase and further improve the skill levels of more than 300 operators from approximately 30 companies across Japan. Using the air separation unit simulator, which was developed for use in education and training and recreates the operating environment of an actual air separation unit, participants compete in areas requiring specialized skills, including time required to reduce gas oxygen volume and time required to collect and increase liquid oxygen volume using liquid nitrogen injection. Winners of local qualifying rounds take part in the final, which is held at our head office in Tokyo. Through initiatives such as this, we continue working to improve core technological capabilities across the entire Taiyo Nippon Sanso Group.



Eight employees made it to the final of the fifth annual competition in March 2019.

Making Use of Intellectual Property

Taiyo Nippon Sanso strives to make use of intellectual property, recognizing it as essential to supporting the competitiveness of its businesses.

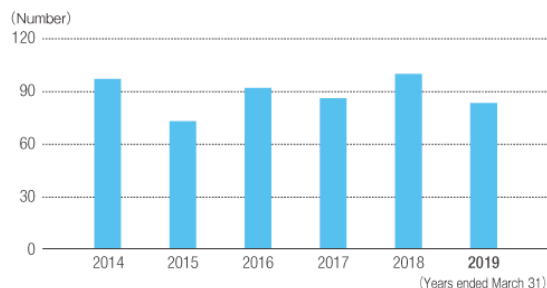
Policy on the Use of Intellectual Property

We actively promote the strategic acquisition, maintenance and application of intellectual property with the aim of ensuring a competitive advantage and contributing to profitability. In addition to respecting the intellectual property rights of third parties, in line with our philosophy of legal and regulatory compliance, we take appropriate measures to protect our intellectual property rights against infringement.

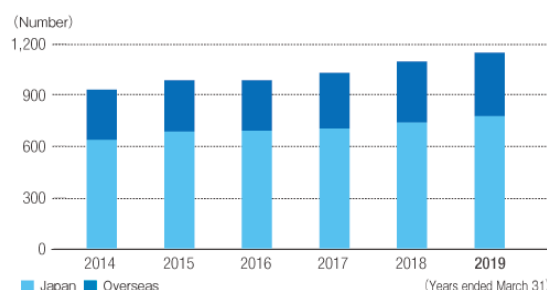
System of Compensation for Inventions

We have established a variety of systems to effectively manage intellectual property, centered on our Rules for Managing Intellectual Property. One of these is a system of compensation for inventions whereby employees devising inventions in the course of performing their jobs are eligible to receive incentives when a patent application is filed, when the patent is registered and when the patent contributes to income. In recent years, approximately 200 such incentives have been paid.

■ Number of Patents Registered in Japan
(Taiyo Nippon Sanso Corporation)

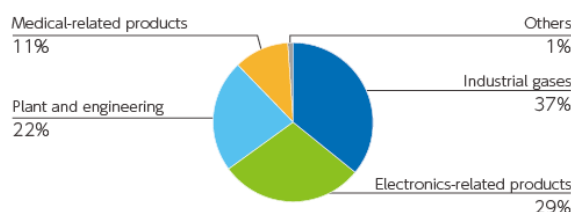


■ Number of Patents Held Worldwide



Note: Number of patents obtained by
Taiyo Nippon Sanso Corporation as of December 31

■ Breakdown of Patent Portfolio in Japan by Business



Number of patents held as of December 31, 2018: 774

Relations with Customers

To ensure safe and stable supplies of industrial gases, we have established systems for process safety management, as well as for quality management and assurance, and strive to appropriately manage information.

Systems for Process Safety and Quality and Product Safety Management

In line with our Rules for Process Safety Management and Rules for Quality and Product Safety Management, we hold an annual Technological Risk Management Conference, which is chaired by the president. This conference is responsible for making decisions on important process safety- and quality-related matters based on the Presidential Policy Directive on Technology Risk Management. Group companies in Japan and overseas conduct regional conferences to incorporate the decisions of the Technological Risk Management Conference into their respective annual action plans and promote the decisive implementation of related measures.

■ Process Safety and Quality and Product Safety Management Framework



* Specified sites are mixed-purpose sites—primarily production and research facilities—that are under direct divisional supervision and for which integrated process safety management is necessary.

Process Safety Management

In line with our belief that selling gases is commensurate with selling safety, we continue working to strengthen independent systems for ensuring process safety and have created a Group process safety management system headed by the president, which underpins a meticulous approach to this key challenge.

In Japan, to ensure our ability to respond promptly and effectively in the event of leaks or other emergencies during the transport or use by customers of specialty gases, we have specified 55 sites across the country as emergency response depots, equipping each with materials and equipment crucial to mitigating damage from such an incident, thereby ensuring a high level of preparedness at all times. Training and drills for emergency response personnel are conducted at least once annually. At present, we have approximately 330 registered emergency response personnel.

To ensure the safe use of our industrial gases, we offer customers safety seminars that provide information on the properties, dangers and safe handling of various products. In addition, we have created a commendation system for parent company and affiliated company production sites to recognize the results of independent safety initiatives.

Overseas, we endeavor to provide safe, stable supplies to customers by providing periodic training aimed at improving employees' technical skills, as well by conducting and improving safety patrols at production sites, thereby ensuring consistent process safety. We also bring together process safety officers from overseas Group companies for annual safety conferences. The fiscal year 2019 conference was held in Hanoi, the capital of Vietnam, and focused on enhancing technical skills and awareness of safety.

As a common global initiative, in June 2018 we established the TNSC Technical Academy at our Kawasaki-Mizue site in the city of Kawasaki. Designed with the goal of reducing mishaps and industrial accidents, the facility provides hands-on hazard training using equipment that makes it possible to simulate the properties of pressurized gases and key causes of industrial accidents such as falling, stumbling or being caught up in machinery. The academy also displays cutaway models of various gas-related equipment and offers seminars focused on accident case studies and developing a safety-oriented corporate culture. Looking ahead, we will step up efforts to provide hands-on training with the aim of eradicating mishaps and industrial accidents from the workplace. We are also working to create unified technical standards for the entire Nippon Sanso Group with the aim of ensuring stringent process safety management worldwide.

Management Inspections and Safety and Environmental Audits

We conduct management inspections and safety and environmental audits at our own sites, as well as at sites operated by affiliated companies to manage technological risks related to, among others, safety, the environment and quality. Management inspections, which are conducted by the general manager of the pertinent Taiyo Nippon Sanso division or branch, are designed to assess the status of safety and environmental initiatives from a management perspective.

Safety and environmental audits, the main goals of which include reinforcing compliance and preventing accidents, are conducted by the Technical Audit Office, in principle every five years, at all Group companies in Japan and overseas. In fiscal year 2019, safety and environmental audits were conducted at 24 sites belonging to 15 companies in Japan and five sites belonging to two companies in two countries overseas (Asia). Internal audits also were conducted in the United States and Europe and information was shared with the Technical Audit Office.

Quality Management and Assurance

In line with the President's Policy Directive on Technology Risk Management, we strive to grasp increasingly sophisticated and diverse customer needs and social imperatives and to respond by providing optimum product quality. To this end, we promote extensive quality management and assurance initiatives aimed at ensuring a high level of quality for our products and services.

In light of recent increases in expectations regarding both quality management and quality assurance, we sought to reconfirm the effectiveness of initiatives implemented to date, as well as to ensure effective compliance, by once again inspecting related systems at affiliated companies in Japan and subsequently expanding this effort to include affiliated companies overseas.

Quality Management System

We have established a quality management system based on ISO 9001, the International Organization for Standardization (ISO)'s standard for quality management systems, which we continue to leverage with the aim of steadily increasing customer satisfaction. Departments and affiliates involved in production—including those involved in the production of industrial gases (oxygen, nitrogen and argon) and the air separation units and supply equipment used in their production and storage, the production and installation of semiconductor fabrication equipment, the production of medical gases and medical gas supply systems, and all areas of our helium and hydrogen businesses—have acquired ISO 9001 certification. Departments handling sales and logistics for liquid oxygen, liquid nitrogen, liquid argon and specialty gases have also earned certification, reflecting our goal of creating a system that ensures not only the quality of our products but also the provision of stable supplies and effective support.

As of April 1, 2019, a total of three divisions and 55 affiliates in Japan and overseas are currently certified under ISO 9001, reaching our target for achieving ISO 9001:2015 compliance. Going forward, we will remain committed to promoting the effective use of our quality management system with the goal of achieving continuous improvements in customer satisfaction.

Site Analytical Management Certification System

Reliable analytical management is seen as critical to the quality of industrial gases. To ensure our ability to provide optimum product quality, we have established a system for certifying production facility analytical management performance and continue to take steps aimed at bolstering the analytical management capabilities of gas production sites.

Product Safety

As outlined in the President's Policy Directive on Technology Risk Management, we work to offer safer and more reliable products by minimizing safety risks over the entire life cycle of our products, thereby ensuring customers can use our products with peace of mind.

For many products, we explore ways to reduce risks from the design stage and consider safety not only during use but at all stages of a product's life cycle, including production, transport, maintenance and scrapping. Product safety assessments are subsequently conducted by individuals who have earned internal qualifications, after which a declaration of conformity with product safety standards is made by representatives of the pertinent division or affiliated company, thereby ensuring the safety of the products we provide.

Information Management

With corporate information leaks an increasingly critical issue, companies face an ever-greater responsibility to manage and protect confidential customer information they accumulate through their business activities.

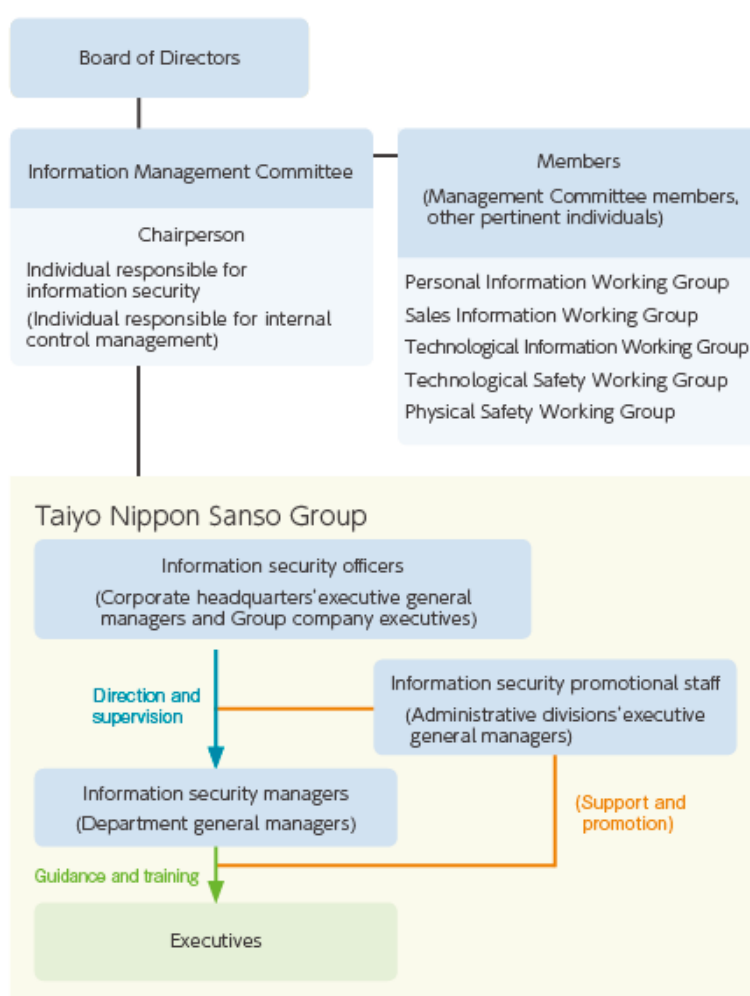
To create a framework for systematic management, our Information Management Committee, established in fiscal year 2018, set forth Rules for Information Security Management to guide our handling of our own and our customers' information.

To maintain this system, we continue to promote initiatives across the Taiyo Nippon Sanso Group to strengthen management practices, including holding periodic seminars to enhance management-level employees' awareness of changes to pertinent laws and regulations and providing guidance to affiliated companies.

Approach to Information Management

1. In line with the Rules for Information Security Management, the individual responsible for information security oversees information security Groupwide and appoints information security officers and promotional staff for each division and information security managers for each department.
2. Department information security managers are charged with identifying confidential information and classifying such information as either “highly confidential” or “proprietary.”
3. Appropriate measures are taken to limit access to confidential information.
4. Confidential information disclosed by customers will be managed at a level equivalent to or higher than our own confidential information.

■ Information Security Management Framework



Relations with Employees

Cultivating Human Resources

As stipulated in the “Respect for human rights” and “Prohibition of discrimination” sections of the Taiyo Nippon Sanso Group Code of Conduct, we are committed to promoting diversity and inclusion and prohibit discriminatory treatment based on factors such as nationality, race, gender or other factors. We also work continuously to enhance our highly practical training programs with the aim of fostering the next generation of “The Gas Professionals.”

Fair and Impartial Hiring Practices

The Taiyo Nippon Sanso Group seeks to secure diverse human resources and have eliminated such potentially discriminatory factors as gender and age from our hiring practices. Our personnel system is based on three key concepts: Put the right person in the right position, ensure impartial evaluations and training, and provide results-based compensation.

Evaluating Employee Performance and Determining Compensation

We have developed job/role-specific criteria for evaluating the performance of and determining compensation for employees. Prioritizing a fixed cycle of actions (fulfill expectations/exercise capabilities → evaluate performance/determine compensation → provide feedback → foster human resources) and repeating this cycle both ensure fairness and impartiality and enhance job satisfaction.

In a bid to invigorate our organization and create a bold, forward-looking corporate culture, in April 2015 we modified personnel systems for management-level employees. We began by seeking to ensure our ability to assign the right people to the right positions in a timely manner by eliminating our vocational qualification system, an essential component of which is seniority, in favor of a system that focuses on performance. Additionally, to enhance profit sharing, we raised the percentage of annual remuneration accounted for by bonuses, thereby creating a system of compensation that is more closely tied to the achievement of medium-term management plan targets.

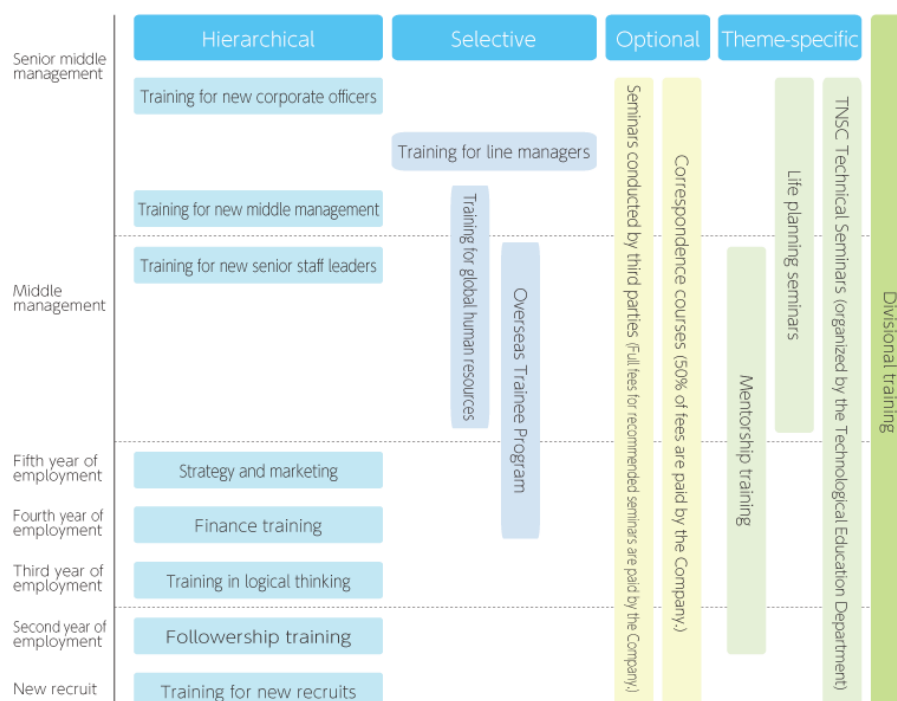
Training “The Gas Professionals”

We believe that companies can provide a place for employees to gain experience, training that increases knowledge and develops skills, and a framework that allows personnel to grow through varied work experiences. Guided by this belief, in fiscal year 2008 we began to build a new educational system comprising programs classified by type, i.e., hierarchical, selective, optional, theme-specific and divisional training.

Regardless of the positions to which they have been assigned, new graduates hired are given basic training for new employees, as well as training on the front lines of manufacturing and sales, thereby ensuring they acquire the expertise and experience demanded of all Taiyo Nippon Sanso employees. Training classified as hierarchical, which is designed to impart crucial knowledge and professional skills, can be taken in the first five years of

employment. In fiscal year 2018, we also began offering training for line managers. Given the rapid globalization of the industrial gases business, we recognize the need to cultivate employees who are able to function in a global business environment. In fiscal year 2017, we launched the Overseas Trainee Program, whereby employees are dispatched to overseas Group companies. (For details, see our 2019 Integrated Report.) We have also created an incentive program for employees seeking to obtain nationally recognized qualifications and subsidies for employees taking correspondence courses.

■ Employee Training Framework (Headed by the HR Division)



Steps have been taken recently to strengthen the Overseas Trainee Program.



Life planning seminars provide information that helps employees prepare for life after retirement.



Strategy and marketing training is provided for employees in their fifth year.



Training for new employees includes a Self-Defense Forces boot camp.

Internal Communications

We are striving to invigorate internal communications with the aim of creating smoothly functioning, open workplaces.

Holding Young Researchers' Conferences

We hold young researchers' conferences four times annually at our Tsukuba and Yamanashi laboratories (The facilities host one conference each independently and collaborate to host the remaining two.). The conferences provide an opportunity for young researchers to present their research, thereby improving their communication skills, as well as to pose questions to other researchers, which increases their comprehension. To encourage active discussion among young employees, there is a rule in place that management members do not ask questions.



Conferences provide an opportunity for communication for young researchers from across the Group.

The Tsukuba Laboratory began conducting young researchers' conferences since 1992, with more than 500 individuals having presented their research to date. Researchers participate actively in Q&A sessions and lead the exchange of opinions on individual presentations, underlining the importance of these events as a source of new ideas and responses to issues.

Enhancing Internal Communications

In Japan, we publish *Best Scrum*, a bimonthly in-house newsletter. In addition to corporate information designed to promote awareness of management policies, share operating results and enhance understanding of Group operations, *Best Scrum* features information on the activities of individual divisions and Group companies and on important new technologies. With the goal of giving *Best Scrum* a personal touch and encouraging communications across the Group, employees across the country are encouraged to submit articles and comments for inclusion to local communications managers.



Best Scrum



Konnichiwa

We also produce *Konnichiwa*, a seasonal English-language newsletter for Taiyo Nippon Sanso Group companies overseas. Each issue of *Konnichiwa* includes summaries of key articles from *Best Scrum* and a section introducing employees in various countries who have made notable contributions to the Group's development and growth, each of which is asked to convey a short message to his or her colleagues around the world.

Working with the Taiyo Nippon Sanso Employees' Labor Union

The Taiyo Nippon Sanso Employees' Union was established in May 2005, and a union shop agreement was concluded in October of the same year. Our policy is to disclose information to the Taiyo Nippon Sanso Employees' Union as much as possible and to consult and negotiate in good faith. Labor-management relations are healthy, and both parties are committed to working and growing together.

■ Labor-Management Negotiations

	Matters discussed	Schedule
Collective bargaining	This is a forum for consultation regarding wages, bonuses and various working conditions based on labor union demands and for discussions between labor and management on a wide range of topics, including important Company initiatives and business conditions.	Regularly held in early March (requested submission date) and April (specified response date)
Central Labor Council	This is a forum for discussing various matters affecting union members in general. In response to proposals from the Company, the union's central executive committee and the executive general manager of the HR Division hold discussions, and financial reports and information on important Company initiatives are presented. Principal matters discussed include amendments to working conditions for union members, permanent reassignments, early retirements and proposed temporary transfers.	Unscheduled (20-30 times/year)
Branch Labor Council	This is a forum for discussing matters related to union members at regional sites. Discussions are held between branch executive committees and local labor managers, i.e., branch general managers, department general managers and department managers. Matters discussed include provisions regarding working hours in Japan's Labor Standards Act and the relocation of sites.	Unscheduled (Frequency varies from one region to another.)

Work Style Reforms

With the goal of creating positive work environments conducive to diversity and a healthy work-life balance, we are promoting changes to existing workplaces that make it possible for employees to achieve balance to their careers and responsibilities at home and that encourage job satisfaction and provide motivation. Our efforts to advance work style reforms have also included promoting the creation systems that facilitate flexible work arrangements.

Creating Positive Work Environments

With the aim of creating positive work environments for all of our employees, we have developed a variety of leave systems to accommodate individual needs. These include a childcare leave system that includes reduced working hours, flextime and other measures designed to assist employees with childcare responsibilities. Initially targeted at employees with children under three years of age, eligibility was later expanded to include employees with children up to the third year of elementary school. In fiscal year 2018, the possible reduction in working hours, previously set at 2.0 hours, was lowered to 1.0 hour, making the system easier to use.

We have also made it possible for employees with children of elementary school age or younger to take special childcare leave to provide nursing care in the event of illness, assist with childcare or attend school functions, or take part in volunteer activities by using expired annual vacation days. Recognizing that the rapid aging of Japan's society will increasingly require employees to assist with long-term nursing care, we established a system for employees to assist with nursing care for elderly family members that enables employees in this position to take long-term leave of up to 365 days. In addition, we created a "Refresh Holiday" system that gives employees special

extra paid vacation days to celebrate their 10th, 20th and 30th years of employment.

Other moves designed to realize more flexible work styles include the adoption in fiscal year 2018 of a leave system that allows employees to accompany spouses on overseas assignments and a rehiring scheme for employees that have resigned because of pregnancy or responsibilities associated with childcare or nursing care. In fiscal year 2019, we introduced a flextime system that allows employees to take vacation time in hourly units.

■ Systems to Assist Employees with Childcare Responsibilities

	Reduced working hours	Flextime
Eligibility	Employees with children up to the third year of elementary school	Employees with children up to three years of age
Duration	Up to the end of the child's third year of elementary school	Up until the month the child turns three years of age (i.e., until the day before the child's birthday)
Terms	Start and/or end of working day can be adjusted in either direction in 30-minute intervals (maximum permitted reduction per day: two hours)	Flextime (Core time: 10:30-15:00)

■ Number of Employees Making Use of Childcare Leave Systems

		Fiscal year 2017	Fiscal year 2018	Fiscal year 2019
Special maternity leave before/after birth		6	2	4
Childcare leave		7	7 (Female employees: 7)	7 (Female employees: 5)
Reduced working hours		9	11 (Female employees: 11)	11 (Female employees: 11)
Flextime		0	0	1 (Female employees: 1)
Special childcare leave	Cumulative number of individuals	42	39 (Female employees: 25; male employees: 14)	75 (Female employees: 46; male employees: 29)
	Cumulative number of days	37.0	52.0 (Female employees: 34.0; male employees: 18.0)	52.5 (Female employees: 33.0; male employees: 19.5)

Promoting the Employment of Individuals with Disabilities

We provide information on opportunities for individuals with disabilities with the goal of further opening the door to employment at our offices across Japan. Such efforts have led to the hiring of individuals to fill positions in a wide range of areas, including general affairs, administration, accounting, sales, distribution, technological management, production control, R&D and engineering. As of March 31, 2019, the percentage of our labor force accounted for by individuals with disabilities exceeded the legal minimum of 2.2%. We will continue working to maintain our employment of individuals with disabilities at above the legally mandated percentage.

Preventing Harassment

The Taiyo Nippon Sanso Group Code of Conduct forbids any act that may be construed as harassment. Our Rules of Employment clearly stipulate the prohibition of harassment and the establishment of hotlines for employees to

seek consultation or report complaints. In addition to providing training to raise awareness of the importance of eliminating harassment, in January 2017 we formulated the President's Policy on the Prevention and Eradication of Harassment in the Workplace, calling on employees to help create positive workplaces by, among others, disseminating information on the policy.

Establishing the Taiyo Nippon Sanso Helpline

We have established the Taiyo Nippon Sanso Helpline to facilitate the swift discovery/correction and prevent the recurrence of compliance violations while also protecting the privacy of whistleblowers. Use of the helpline is governed by the Guidelines for Use of the Taiyo Nippon Sanso Helpline, which also outline robust protections that prohibit anything unfavorable to whistleblowers.

Providing a Working Environment that Encourages Innovation and Diversity

At our Shiba Office, home of the Innovation Division, an independent team within the Global Operations Division, we strive to facilitate global business expansion and value creation by providing a working environment conducive to the development of original ideas and new value and to job satisfaction for a wide range of human resources. As part of this effort, we have established an open area on the eighth floor of the office based on the concept of “a work/lounge/office where employees can choose how and where they work.” The space is suitable for a wide range of uses, including meetings, as a workspace and for presentations using large displays.

The Innovation Division brings together diverse human resources, including a number of foreign nationals. In addition to facilitating in-house communication, the open area has also proven useful in encouraging innovation and diversity.



Eighth floor open area equipped with tables, counters, meeting spaces and large displays

Health Management

We strive to create work environments that support and motivate employees. To this end, we are promoting measures in three areas: Healthy people, healthy workplaces, and healthy families and communities. We have positioned safety and health in the workplace as a key priority in the Taiyo Nippon Sanso Group Code of Conduct and have formulated the Rules for Occupational Health and Safety, in line with which we are promoting a variety of initiatives.

Taiyo Nippon Sanso's Health Management Declaration

— *Creating a work environment that supports and motivates employees* —

On April 1, 2017, we announced the Taiyo Nippon Sanso Health Management Declaration, the subtitle of which is "Creating a work environment that supports and motivates employees." This declaration reiterates our belief that achieving sustainable growth depends on our ability to maximize our human resources, one of our most important assets, by actively promoting initiatives that support employee wellness and work style reforms.

Taiyo Nippon Sanso's Health Management Declaration

Creating a work environment that supports and motivates employees

We look for three key qualities in our employees, namely, health, integrity and resourcefulness. With the aim of giving form to the first of these, health, and recognizing that employee health is the driving force behind everything we do, we hereby declare our commitment to promoting sound corporate management and helping realize a spiritually affluent society through the creation of a health-first corporate culture.

Recognizing the health and wellness of all of our employees as a crucial corporate asset, we will also strive to realize secure and pleasant workplaces. We also understand that the health and wellness of each individual employee and of his or her family is a critical motivating factor for employees in both their professional and private lives. Accordingly, we encourage employees to be proactive in maintaining their own health and ask for their active participation in the creation of a health-first corporate culture.

April 1, 2017

Yujiro Ichihara

Representative Director, President CEO

Taiyo Nippon Sanso Corporation

In 2019, we earned certification in the large enterprise category (dubbed the "White 500") of the Health & Productivity Outstanding Entities Program, marking the second consecutive year we have been so honored. The program was established in 2017 by Japan's Ministry of Economy, Trade and Industry (METI) and Nippon Kenko Kaigi ("Japan Health Council") to recognize companies with particularly excellent health management practices that are consistent with community health issues and health promotion activities undertaken by Nippon Kenko Kaigi. In addition, in October 2018 the initiatives of Group company Taiyo Nippon System Solutions Corporation, which announced a Healthy Business Declaration* in December 2017, were recognized with a silver commendation, recognizing success in the first step of the Healthy Businesses Program.

Note: A Healthy Business Declaration is a declaration of a company's commitment to promoting health at all business sites with the aim of earning designation under the Healthy Business Program, which is operated by the Tokyo Branch of the National Federation of Health Insurance Societies. Companies achieving a certain level of success are certified as Healthy Businesses. Step 1 of the program involves creating a workplace and work environment that is conducive to health management.

Promoting Employee Health

In addition to arranging consultations with doctors for employees who work long hours, employees on unaccompanied postings are required to undergo annual medical and brain health checks in addition to the annual health checks mandatory for employees. To support employee wellness, in fiscal year 2018 we began subsidizing employees using healthcare facilities or taking part in health promotion programs and distributing wearable health monitoring devices to increase the visibility of individual health-related data. We have also collaborated with industrial physicians and health insurance societies to assign such physicians to all sites across Japan, enabling us to respond to health issues related to extreme overwork, expedite support for employees who have taken leave for the treatment of mental health issues returning to work, revise items covered in annual health checks to facilitate the early detection of cancer, and introduce subsidies for employees obtaining influenza vaccinations and treatment to quit smoking.



Stretching
(Health of Working Women seminar)

In a new initiative, in fiscal year 2019 we held the first Improving the Health of Working Women seminar at our corporate headquarters in Tokyo. Three female speakers—a nutritionist, public nurse and trainer—were invited from Pasona Inc., a personnel placement firm noted for promoting career advancement for women, to speak at the seminar, which focused on three central themes (female hormone-related issues, exercise and diet). Going forward, we will continue working to create healthy working environments that enable female employees to pursue successful careers.

We also conduct health checks for former employees who in the past worked with asbestos and have expressed a desire to receive such checks and have set up a system to compensate individuals whose health has been negatively affected as a result of their work with asbestos.

Caring for Mental Health

We have introduced an employee assistance program (EAP) provided by a third-party specialist and set up an external counseling service. At the same time, we have continued to take steps to support mental health care, including establishing a support program for employees who have taken leave for the treatment of mental health issues returning to work.

■ Participants in Mental Health Care Training

Period	Management-level participants	Executive-level participants
Fiscal year 2015	25	38
Fiscal year 2016	37	38
Fiscal year 2017	32	24
Fiscal year 2018	32	28
Fiscal year 2019	35	29

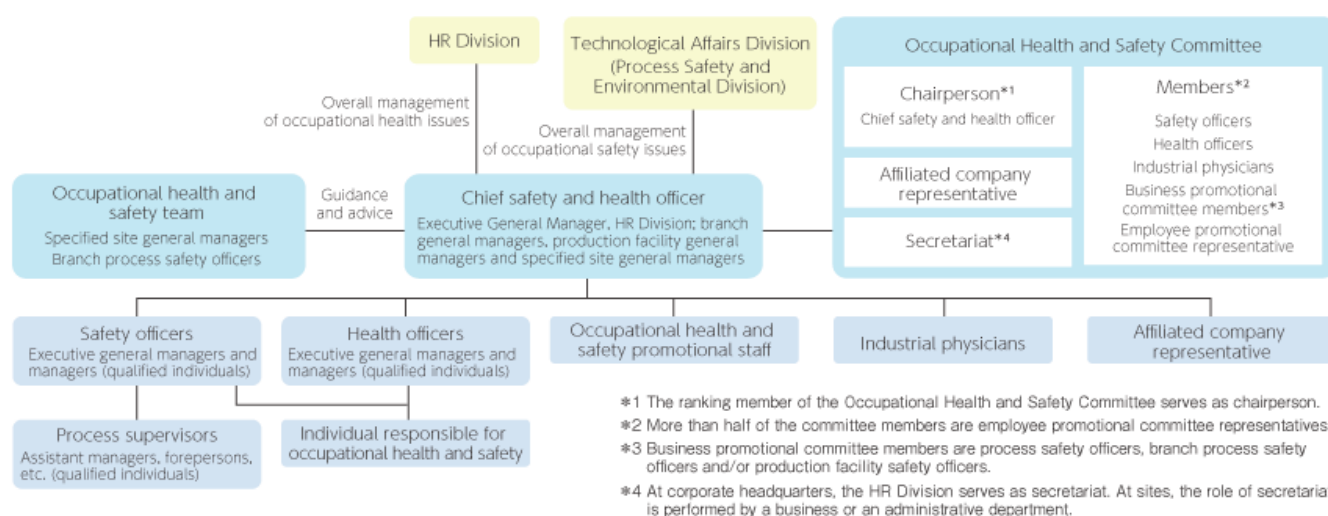
Employee Welfare Program

We have created a welfare program that provides extensive support for employees. In addition to Company housing or dormitory accommodations for individuals on temporary transfers, the program provides rent subsidies for married employees, subsidies for employees who are homeowners and a mortgage system for employees purchasing homes that includes a Company guarantee, a preferential interest rate and an interest subsidy. The program also makes it possible for current employees and family members, as well as retired employees, to use three Company-owned recreational facilities.

Occupational Health and Safety

In line with our Rules for Occupational Health and Safety, we promote a variety of efforts in Japan to ensure health and safety in the workplace. Based on these rules, we have created an occupational health and safety team and an Occupational Health and Safety Committee at each site. In addition, we continue to promote efforts to eliminate workplace accidents. These include providing safety training and holding morning assemblies, offering Kiken Yochi Training (KYT) (“hazard prediction training”) and introducing 5S (a workplace organization methodology based on five words (*Seiri* (Sort), *Seiton* (Set in Order), *Seiso* (Shine), *Seiketsu* (Standardize) and *Shitsuke* (Sustain)). We also distribute *Health and Safety News*, an electronic newsletter that includes materials published by the Japan Industrial Safety & Health Association (JISHA), among others, to raise employee awareness.

■ Site Occupational Health and Safety Management Framework



Relations with Suppliers

Keenly aware of the importance of green procurement and CSR procurement, we also expect our business partners to consider environmental and social issues in conducting their operations.

Maintaining Fairness and Impartiality in Selecting Suppliers

Across the Taiyo Nippon Sanso Group, procedures for choosing suppliers of raw materials and engineering services are based on the principles of fairness and impartiality, thus ensuring equal opportunities for all parties irrespective of country of origin, size or track record.

As active advocates of green procurement and CSR procurement, we regard concern for the environment and compliance with relevant laws and regulations as essential to our operations and require that our suppliers do the same. Accordingly, these two considerations are the principal standards we use to evaluate applicants.

Taiyo Nippon Sanso Major Club

In April 2005, we launched an official dealer system, dubbed the Taiyo Nippon Sanso Major Club, with the aim of responding accurately and effectively to the needs of end users across Japan. In addition to providing official dealers (“partner companies”) with competitive products, we leverage our position to provide a wide range of services, including domestic and overseas sales support, technical assistance and management consultation.

The Taiyo Nippon Sanso Major Club—comprising the core Partners’ Club and two functional subgroups, the LP Gas Club and the Medical Club—boasts a robust national network that is instrumental in ensuring our products are delivered safely and reliably to end users. Each constituent club offers seminars and training sessions on operational safety and other themes. In fiscal year 2019, the Medical Club conducted training sessions at six locations, in which a total of 270 individuals participated. A training session held by the LP Gas Club members in Tokyo welcomed 87 participants from 63 companies. Exchanges, training sessions and production facility tours were also conducted for Partners’ Club companies in multiple other areas.

Going forward, we will continue working to reinforce customer satisfaction and enhance our reputation in society as an organization worthy of trust through ongoing initiatives in collaboration with Taiyo Nippon Sanso Major Club partners.

■ Taiyo Nippon Sanso Major Club



Relations with Shareholders and Investors

We strive to ensure the timely disclosure of corporate and financial information and to ensure fair returns to shareholders.

Communication with Shareholders and Investors

In addition to our annual general meeting of shareholders, we conduct results presentations, facility tours and other events for institutional investors and sell-side analysts. Results presentations make use of visual aids to deepen understanding of our operations, operating results and our forecasts for the future. Facility tours are designed to enhance understanding of what we do and include regularly scheduled visits to both production facilities and research laboratories. In March 2019, we conducted a tour of the Chiba Sanso Center Co., Ltd. with the aim of introducing shareholders and investors to our industrial gases business. In September 2018, we conducted a tour of subsidiary Japan Fine Products Co., Ltd.'s Mie Plant in cooperation with Mitsubishi Chemical Holdings. We also organized a joint IR seminar with Mitsubishi Chemical Holdings and Tanabe Co., Ltd., another member of the Mitsubishi Chemical Holdings Group.

We also released a number of regular publications for shareholders and investors, including full-term and interim business reports and a single integrated report that provides both financial information, such as that related to business strategies and operations, and non-financial information, including that related to environmental protection, social contribution and corporate governance, with the aim of giving readers an accurate overall picture of the Taiyo Nippon Sanso Group.

Enhancing our corporate website is another key focus of our efforts. As well as various key documents, the website provides a compact outline of our various businesses in a compact, easy-to-understand form and other content that give even first timers a clear view of the Group and its activities.

Corporate website's IR section: <https://www.tn-sanso.co.jp/en/ir/index.html>



Tour of Japan Fine Products' Mie Plant for institutional investors and securities analysts

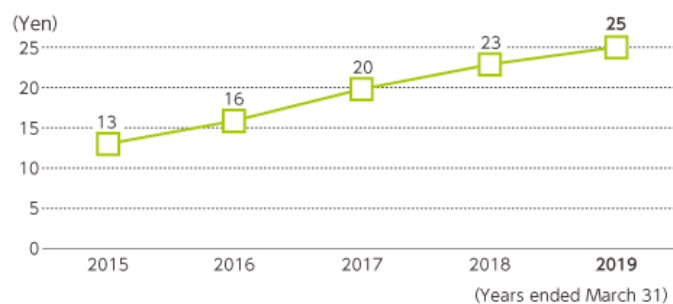


Results presentation

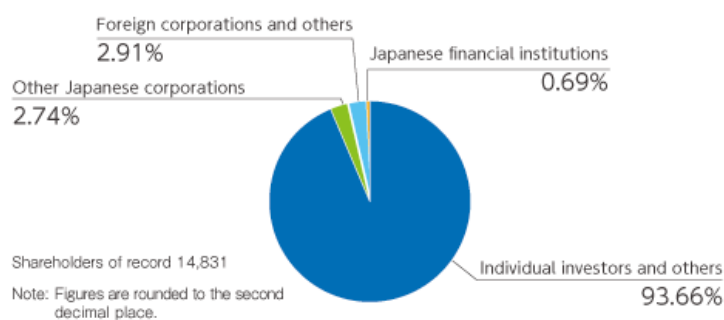
Ensuring Fair Returns to Shareholders

Having positioned the provision of fair returns to shareholders as a key management responsibility, we strive to maintain stable dividends, while at the same time ensuring our dividend payout ratio fairly reflects our business performance. Guided by the strategic policy set forth in our medium-term management plan, we will continue working to enhance our performance.

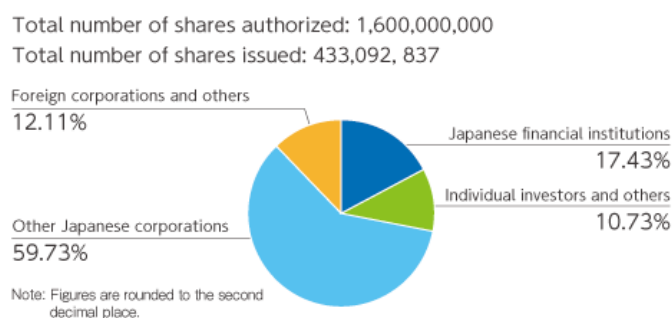
■ Annual Cash Dividends per Share



■ Distribution of Shareholders (As of March 31, 2019)



■ Distribution of Shares Held (As of March 31, 2019)



Relations with Local Communities

As a provider of industrial gases, we recognize that we have a mission to communicate the technologies and potential of industrial gases, as well as to work actively with local communities.

Shanghai Taiyo Nippon Sanso Gas Wins Commendations for Work Safety

Shanghai Taiyo Nippon Sanso Gas Co., Ltd., headquartered in Shanghai's Xinzhuang Industrial Zone, recently received two commendations from the zone's Shanghai Municipal Administration of Work Safety. The first commendation, in 2018, recognized top performers in terms of occupational safety, and was given to 21 of the 588 companies in the zone. The second, which was awarded to the company's tanker truck drivers, was one of three recognizing contributions to safe transport in 2018. The company has received similar commendations in the past, but, with the tightening of safety regulations in China, these awards are evidence of the country's positive assessment of the Taiyo Nippon Sanso Group's occupational safety efforts. Looking ahead, we will continue to promote a variety of initiatives in line with our belief that selling gases is commensurate with selling safety.



Commendation for occupational safety and contributions to safe transport

Kyushu Cryogenics Receives 2018 Minister's Award for High Pressure Gas Safety

In 2018, Kyushu Cryogenics Co., Ltd., which has maintained an accident- and disaster-free record since its establishment, was honored with a Ministry of Economy, Trade and Industry (METI) Minister's Award for High-Pressure Gas Safety,* earning recognition for excellent production facilities (i.e, facilities where outstanding measures have been implemented to ensure the safety of structures, equipment and production processes). As of November 30, 2018, the company, which began operating on July 1, 1984, had recorded approximately 12,570 days in operation with no occupational accidents or disasters. Seeing this award as an opportunity to further enhance its spotless record, the company will continue to place a high priority on safety in the workplace, in line with its president's policy of ensuring the safe production and sale of high-pressure gases.



Awards ceremony at Tokyo's ANA Crowne Plaza Hotel (October 26, 2018)

* The METI Minister's Award for High-Pressure Gas Safety commends high-pressure gas production facilities that have attained excellence through tireless efforts to prevent accidents and disasters as well as individuals who have recorded exceptional achievements over many years in the area of high-pressure gas process safety.

Matheson Tri-Gas Wins CGA Safety Awards

On April 24, 2018, the U.S. Compressed Gas Association (CGA) announced winners of its safety awards for 2018 at its annual meeting, which was held in Florida. In addition to earning its second consecutive Fleet Safety Excellence Award in the Bulk Vehicle Fleets category, Matheson Tri-Gas, Inc. won the Environmental Recognition Program Award for its efforts in 2017 to reduce argon gas losses. Matheson Tri-Gas subsidiary Western International Gas and Cylinders, Inc. won its second consecutive Fleet Safety Excellence Award in the Cylinder Vehicle Fleets category.

The CGA was created to establish safety standards and promote safe practices in the industrial gases and medical gases industries. The association presents awards annually to companies and individuals exhibiting industry leadership in the areas of safety and environmental performance. Matheson Tri-Gas places a high priority on companywide safety and environmental considerations. As evidenced by its CGA awards, the company continues to earn recognition across the industry for its efforts.



Fleet Safety Excellence Award
(Bulk Vehicle Fleets category)
winner: Matheson Tri-Gas



Fleet Safety Excellence Award
(Cylinder Vehicle Fleets category) winner:
Western International Gas and Cylinders

Welcoming Visits by High School Students

In response to a request from the nonprofit organization School Support Center, we actively encourage visits to our facilities by junior and senior high school students. In June 2018, we invited seven year-two students from Okayama Prefectural Saidaiji Senior High School to visit our corporate headquarters in Tokyo to learn about our operations and technologies. In addition to asking business-related questions, the students queried employees about a variety of other topics, including job satisfaction and career choice. Going forward, we will continue to assist in career education by providing opportunities for students to learn about the industrial gases field.



Using items from everyday life to explain
what Taiyo Nippon Sanso does

Thermos Collaborates with Volunteer Environmental Initiative and Participates in Team ECO Work! 224 Event

In September 2018, 48 Thermos employees and family members took part in Team ECO Work! 224 Thermos Zero Waste Action at Teradomari Central Beach Resort, a post-season beach cleanup initiative sponsored by the UX Niigata Television Network 21, Inc., on the prefecture's Teradomari coast. Thermos collaborates actively with the UX Niigata Television Network 21's Team ECO: Nature Support Declaration project and has now participated in this particular volunteer initiative three times.



Team ECO Work! 224 participants

The Team ECO: Nature Support Declaration project is a volunteer initiative led by local residents and companies in Niigata Prefecture. In addition to beautifying the environment, the initiative aims to deepen people's love of nature and thus is a good fit with Thermos' own environmental activities. The event also provides a valuable opportunity for Thermos to communicate with local residents.

Lab Lessons Using Liquid Nitrogen

Our Taiyo Nippon Sanso Kids' Science Class lab lessons seek to encourage children to take an interest in science by giving them the chance to participate in hands-on experiments using liquid nitrogen. These lab lessons enable children to actually experience the use of liquid nitrogen by, for example, freezing roses, and continue to earn high marks not only from participating children but also from their teachers and parents, as well as from local residents. In 2018, we conducted a lab lesson featuring an explanation and demonstration of industrial gases followed by a variety of experiments, including testing roller coaster superconductivity and freezing inflated balloons for 16 fifth-year students as part of nearby Shinagawa Municipal Ushiroji Elementary School's open house, in which we participate every year. Looking ahead, we will continue looking to expand opportunities to offer lab lessons to broaden understanding of the Taiyo Nippon Sanso Group.



Experiment in freezing roses



Experiment using the mechanism that results in clouds to generate white smoke

Sergio Soccer Clinic 2018

Established as an event to commemorate the 80th anniversary of the founding of Taiyo Nippon Sanso's predecessor Nippon Sanso Corporation, the Sergio Soccer Clinic was first held in 1990 with the cooperation of the Chiba-shi Football Association. The objectives of the first clinic—which took place at our Chiba multipurpose athletics field, newly refurbished for the anniversary—were to create an event that would be enjoyed by the local community and to contribute through sports to better health for children. Since 2005, we have also sponsored a clinic in Osaka in collaboration with the Osaka Football Association.

These clinics, which are attended by elementary-school-age teams affiliated with local football associations, include coaching by Brazilian-born Sergio Echigo, a well-known soccer commentator and former professional player, as well as a number of other players from the amateur and professional football worlds in Japan. Features include friendly matches against a team made up of clinic instructors, as well as a round-robin tournament for participating teams. In the two-plus decades since it started, the Sergio Soccer Clinic has welcomed more than 19,000 children. It is our hope that the clinic will continue to contribute to the development of talented young players.



A total of 455 children from 48 teams affiliated with the Chiba-shi Football Association took part in the Sergio Soccer Clinic in Chiba, which featured five coaches, including Sergio Echigo.



Sergio Echigo and six other coaches welcomed 316 children from 36 teams affiliated with the Osaka Football Association to the 2018 Sergio Soccer Clinic in Osaka.

Non-Financial Data

Key non-financial data for the Taiyo Nippon Sanso Group (environmental, social, governance and intellectual property/R&D-related data) is provided in the Non-Financial Data.

Environmental Data

Greenhouse Gas Emissions

- ☐ Scope 1: Direct greenhouse gas emissions from sources that are owned or managed by a company
- ☐ Scope 2: Indirect greenhouse gas emissions resulting from the use of electric power, steam and heat
- ☐ Scope 3: Indirect greenhouse gas emissions other than those included in Scope 2

Reporting boundary: Taiyo Nippon Sanso, directly owned consolidated subsidiaries in Japan and principal consolidated subsidiaries overseas Greenhouse gas emissions in Japan are calculated using emissions factors provided in Japan's Act on Promotion of Global Warming Countermeasures. For greenhouse gas emissions overseas, Scope 1 emissions are calculated using emissions factors set forth in Japan's Act on Promotion of Global Warming Countermeasures, while Scope 2 emissions are calculated using country-specific emissions published by the International Energy Agency (IEA) in 2016. While not indicated below, Scope 3 emissions in categories 1, 2, 3, 4, 6, 7, 11 and 15 are also included.

(Years ended March 31)

Thousands of tonnes of CO ₂	2017	2018	2019
Scope 1	9	19	14
Scope 2	3,363	3,838	4,056
Scope 3	—	3,671	3,634

Contributions to Environmental Protection through Products*

Reporting boundary: Taiyo Nippon Sanso, directly owned consolidated subsidiaries in Japan

Contributions to the reduction of greenhouse gas emissions are calculated in accordance with the Japanese Ministry of Economy, Trade and Industry's Guidelines for Quantifying GHG Emissions Reduction Contribution (formulated in March 2018).

* I.e., by increasing sales of environment-friendly products such as hydrogen refueling stations, Scope-JET®, MG Shield®, SF6 Recovery Service and Thermos products

(Years ended March 31)

Thousands of tonnes	2017	2018	2019
Contribution to reduction in CO ₂ emissions	—	1,734	1,779

Energy Consumption

Reporting boundary: Taiyo Nippon Sanso, directly owned consolidated subsidiaries in Japan and principal consolidated subsidiaries overseas (except for fiscal year 2017, when the reporting boundary for fuel and heat was Taiyo Nippon Sanso and directly owned consolidated subsidiaries in Japan)

The unit calorific values for fuel used are calculated based of values provided in Japan's Act on the Rational Use of Energy.

(Years ended March 31)

Thousands of GJ	2017	2018	2019
Energy consumption	62,516	67,613	72,014
Electric power	62,117	66,875	70,890
Fuel	189	398	418
Heat	210	340	706

Environmental Impact

Reporting boundary: Taiyo Nippon Sanso and directly owned consolidated subsidiaries in Japan

(Years ended March 31)

Tonnes	2017	2018	2019
NOx emissions	—	—	3
SOx emissions	—	—	1
Particulate emissions	—	—	1
VOC emissions	13	14	10
COD emissions	—	—	10
Nitrogen emissions in wastewater	—	—	11
Phosphorus emissions	—	—	1
Emissions of substances designated under the Pollutant Release and Transfer Register (PRTR)	35	29	29

Fresh Water Withdrawn (Excludes seawater)

Reporting boundary: Gas production facilities of Taiyo Nippon Sanso and subsidiaries in Japan and principal consolidated subsidiaries overseas

(Years ended March 31)

Thousands of m ³	2017	2018	2019
Fresh water withdrawn	10,145	10,921	13,623

Waste

Reporting boundary: Taiyo Nippon Sanso and directly owned consolidated subsidiaries in Japan

(Years ended March 31)

Tonnes	2017	2018	2019
Waste discharged	2,917	2,910	3,023
Waste disposed of (landfilled)	385	379	362
Toxic waste discharged	149	240	156

Environmental Accounting

Reporting boundary: Taiyo Nippon Sanso and four directly owned consolidated subsidiaries in Japan (Japan Fine Products Co., Ltd.; Taiyo Nippon Sanso Engineering Corporation; Nissan Unyu K.K. and Thermos K.K.)

(Years ended March 31)

Millions of yen	2017	2018	2019
Environmental protection costs			
Investments	5,323	11,740	9,655
Costs	807	732	844
Environmental protection benefits	14	1,375	15

Social Data

Employees (consolidated)

(Years ended March 31)

Number of individuals	2017	2018	2019
Employees (consolidated)	15,860	16,746	19,229
Japan	5,827	6,172	6,461
Overseas	10,033	10,574	12,768

Employees (Registered Employees of Taiyo Nippon Sanso)

(Years ended March 31)

Number of individuals	2017	2018	2019
Employees (registered employees of Taiyo Nippon Sanso)	1,890	1,940	1,983
Employees overseas	70	79	76
Employees overseas as a percentage of total labor force	3.7%	4.1%	3.8%
Employees by gender			
Male	1,716	1,746	1,758
Female	174	194	225
Employees by age group			
20s and below	312	330	355
30s	358	379	393
40s	721	664	631
50s	499	567	604
Years of consecutive service	18.7	18.5	18.1
Male	18.9	18.8	18.6
Female	17.0	15.5	14.4
Average age	42.8	43.5	42.6
New hires	70	90	108
Separations (including retirees)	42	44	55
Union members (Taiyo Nippon Sanso is a union shop.)	995	1,048	1,106
Union members as a percentage of total labor force	52.6%	54.0%	55.8%
Layoffs	0	0	0

Diversity (Registered Employees of Taiyo Nippon Sanso)

(Years ended March 31)

	2017	2018	2019
Female employees as a percentage of total labor force	9.2%	10.0%	11.3%
Female employees in management positions as a percentage of the management team	1.2%	1.5%	1.4%
Individuals with disabilities as a percentage of total labor force	2.0%	2.0%	2.2%
Number of individuals reemployed after retirement	46	51	57

Work—Life Balance (Registered employees of Taiyo Nippon Sanso)

(Years ended March 31)

Number of individuals	2017	2018	2019
Employees using childcare leave systems	9	7	7
Male	2	0	2
Female	7	7	5
Employees using nursing care leave or long-term nursing care leave	0	0	0
Usage rate for annual paid leave	56.7%	60.0%	61.3%

Other (Registered employees of Taiyo Nippon Sanso)

(Years ended March 31)

	2017	2018	2019
Employees using volunteer leave system	2	0	4
Contributions to social contribution initiatives (thousands of yen)	49,021	57,623	40,396
Employee job satisfaction (scale of 15) (calculated based on in-house research)	3.79	4.00	3.74

Occupational Health and Safety

Reporting boundary: Taiyo Nippon Sanso, consolidated subsidiaries in Japan and overseas (principal production departments) (Data used in fiscal year 2019 includes data for Europe for the three months ended March 31, 2019.)

(Years ended March 31)

	2017	2018	2019
Frequency rate of occupational accidents resulting in lost workdays (number of injuries/deaths due to occupational accidents per million work hours)			
Japan	0.71	0.45	0.71
Overseas	4.09	4.15	3.20

Management Configuration

(Years ended March 31)

	2017	2018	2019
Directors (number of individuals)	10	7	6
Inside directors	8	5	4
Independent outside directors	2	2	2
Directors serving concurrently as executive officers	5	2	3
Percentage of directors serving concurrently as executive officers	50.0%	28.6%	50.0%
Independent outside directors as a percentage of total Board of Directors members	20.0%	28.6%	33.3%
Female directors as a percentage of total Board members	0.0%	0.0%	0.0%
Term of appointment (years)	1	1	1
Frequency of Board of Directors' meetings (meetings/year)	13	11	15
Attendance at Board of Directors' meetings	97.7%	98.9%	97.8%
Attendance of independent outside directors at Board of Directors' meetings (percentage of directors)	100.0%	95.5%	96.7%
Number of directors attending less than 75% of Board of Directors' meetings	0	0	0
Audit & Supervisory Board members	4	4	4
Inside Board members	1	1	1
Independent outside Board members	3	3	3
Independent outside Board members as a percentage of total Audit & Supervisory Board members	75.0%	75.0%	75.0%
Female Board members as a percentage of total Audit & Supervisory Board members	0.0%	0.0%	0.0%
Frequency of Audit & Supervisory Board meetings (meetings/year)	17	13	18
Attendance at Audit & Supervisory Board meetings	100.0%	100.0%	100.0%
Attendance of independent outside Board members at Audit & Supervisory Board meetings (percentage of directors)	100.0%	100.0%	100.0%
Number of Board members attending less than 75% of Audit & Supervisory Board meetings	0	0	0
Average age of directors and Audit & Supervisory Board members	66.6	67.1	65.5
Number of executive officers	28	25	23
Female executive officers as a percentage of total executive officers	0.0%	0.0%	0.0%

Activities of Committees

(Years ended March 31)

	2017	2018	2019
Advisory Committee on Appointments and Remuneration members	4	3	3
Inside Committee members	2	1	1
Independent outside Committee members	2	2	2
Frequency of Advisory Committee on Appointments and Remuneration meetings (meetings/year)	2	6	8
Attendance at Advisory Committee on Appointments and Remuneration meetings	100.0%	100.0%	100.0%
Frequency of Management Committee meetings (meetings/year)	12	16	21
Attendance at Management Committee meetings	98.3%	99.6%	99.1%
Frequency of KAITEKI Promotion Committee meetings (meetings/year)	2	2	2
Attendance at KAITEKI Promotion Committee meetings	100.0%	100.0%	100.0%
Frequency of Technological Development Committee meetings (meetings/year)	2	2	2
Attendance at Technological Development Committee meetings	100.0%	100.0%	100.0%
Frequency of Investment Committee meetings (meetings/year)	1	2	2
Attendance at Investment Committee meetings	100.0%	100.0%	97.3%
Compliance Committee members	33	33	33
Frequency of Compliance Committee meetings (meetings/year)	2	2	2
Attendance at Compliance Committee meetings	100.0%	100.0%	100.0%
Global Compliance Committee members	—	14	20
Frequency of Global Compliance Committee meetings (meetings/year)	—	1	1
Attendance at Global Compliance Committee meetings	—	100.0%	100.0%
Risk Assessment Committee members	15	18	21
Frequency of Risk Assessment Committee meetings (meetings/year)	1	1	1
Attendance at Risk Assessment Committee meetings	100.0%	100.0%	100.0%
Technological Risk Management Committee members	18	19	19
Frequency of Technological Risk Management Committee meetings (meetings/year)	2	2	2
Attendance at Technological Risk Management Committee meetings	100.0%	97.6%	100.0%

Remuneration for Officers

(Years ended March 31)

Millions of yen	2017	2018	2019
Remuneration for directors (excluding independent outside directors)	455	331	249
Basic remuneration*	455	331	151
Performance-linked bonuses	—	—	97
Remuneration for Audit & Supervisory Board members (excluding independent outside members)	25	25	25
Basic remuneration	25	25	25
Remuneration for independent outside officers	103	102	102
Basic remuneration	103	102	102
Remuneration for independent auditors	160	162	212
Remuneration for audit services	157	161	209
Other remuneration for independent auditors	3	1	3

* In fiscal years 2017 and 2018, basic remuneration for directors included performance-linked bonuses.

Other Data

(Years ended March 31)

	2017	2018	2019
Anti-takeover measures	Not adopted	Not adopted	Not adopted
Code of ethics	Adopted	Adopted	Adopted
Policy on transparency of tax affairs	Adopted (internal)	Adopted (internal)	Adopted (internal)
Taiyo Nippon Sanso Group Code of Conduct, Code of Conduct Guidebook (rules for the prevention of corruption, bribery, conflict of interest transactions and leaks of trade secrets, etc.)	Adopted (internal)	Adopted (internal)	Adopted (internal)
Corporate political contributions (yen)	0	0	0
Violations of rules for the prevention of corruption	0	0	0
Monetary penalties incurred as a result of violations of guidelines for the prevention of corruption (yen)	0	0	0

Intellectual Property and Research and Development Data

Intellectual Property

Registered patents as of December 31

(Years ended March 31)

Patents	2017	2018	2019
Registered patents	1,029	1,094	1,147
Japan	701	738	774
Overseas	328	356	373

R&D

(Years ended March 31)

Millions of yen	2017	2018	2019
Research and development expenses	3,323	3,255	3,494
Gas business in Japan	2,660	2,612	2,846
Gas business in the United States	600	593	614
Thermos business	62	48	34

Environmental Management

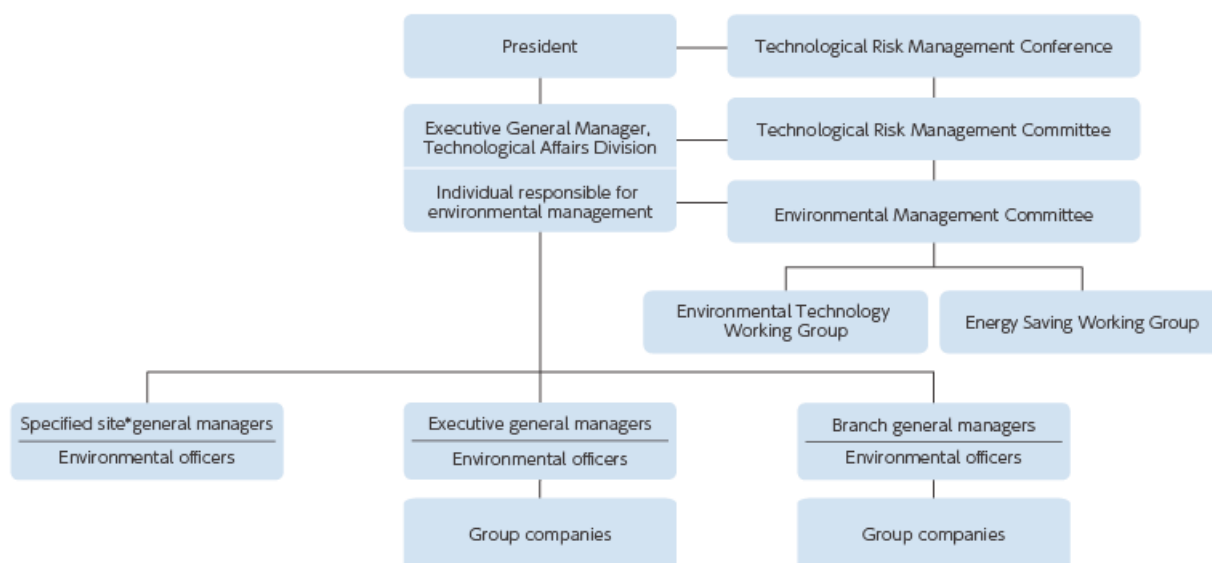
We have established a framework for promoting a broad range of initiatives with the aim of contributing to environmental protection.

Environmental Management Framework

In line with our Rules for Environmental Management, our Environmental Management Committee, which is chaired by the individual responsible for environmental management, meets once annually. We have established an Environmental Technology Working Group and an Energy Saving Working Group as subsections of the Environmental Management Committee to guide our efforts to address particularly important challenges.

The Environmental Management Committee's annual meeting formulates decisive initiatives to address issues determined by the Technological Risk Management Conference and deliberates annual activity reports and activity plans for the Company as a whole, corporate headquarters, branches, specified sites and working groups.

■ Environmental Management Framework



* Specified sites are mixed-purpose sites—primarily production and research facilities—that are under direct divisional supervision and for which integrated process safety management is necessary.

Environmental Training

We provide a wide range of environmental training to all employees with the aim of raising employee awareness of environmental initiatives. Our environmental training program encompasses components focusing on environmental targets, environmental laws and regulations and emergency responses, as well as training for internal auditors.

New recruits are given basic Group training for new employees to promote the understanding of basic environmental issues and encourage familiarity with the Taiyo Nippon Sanso Group's environmental initiatives and

achievements.

Certification under ISO 14001

A total of 11 Taiyo Nippon Sanso Group companies in Japan, including the parent company, and seven Taiyo Nippon Sanso Group companies overseas, have obtained certification under ISO 14001, the International Organization for Standardization (ISO)'s standard for environmental management systems.

■ Taiyo Nippon Sanso Corporation

1. Certifying body: KHK-ISO Center
2. Registration date: October 26, 2001
3. Registration number: O1ER-162
4. Organization registered: Taiyo Nippon Sanso Corporation and the Sagamihara and Oyama plants of Shin Sagami Sanso Co., Ltd.

■ Principal Group Companies Certified under ISO 14001

Japan	Overseas
Thermos K.K. Shizuoka Sanso Inc. Japan Fine Products Co., Ltd. Sogo Kariya Sanso Corporation Taiyo Nippon Sanso Engineering Corporation Taiyo Nippon Sanso Gas and Welding Corporation Taiyo Nippon Sanso Higashikanto Corporation Daiichikaimei Co., Ltd. Nippon Ekitan Corporation Nissan Tanaka Corporation Funtaigiken Co., Ltd.	Air Products Industry Co., Ltd. Ingasco, Inc. Vietnam Japan Gas Joint Stock Company Taiyo Nippon Sanso Engineering Taiwan, Inc. Taiyo Nippon Sanso Taiwan, Inc. Dalian Changxing Island Taiyo Nippon Sanso Gas Co., Ltd.

Acquisition of Green Management Certification

Green Management is an environmental certification system for companies engaged in transportation, including those operating truck, bus and taxi fleets, administered by the Foundation for Promoting Personal Mobility and Ecological Transportation. Efforts to reduce the environmental impact of their operations are screened based on the foundation's Green Management Promotion Manual, with companies judged to be implementing particularly key initiatives earning Green Management certification and registered. A total of 11 of the 20 Taiyo Nippon Sanso Group and subcontracted logistics companies* we use, including Nissan Unyu K.K., have earned Green Management certification.

*For more information, see Environmental Data.

Protecting the Environment

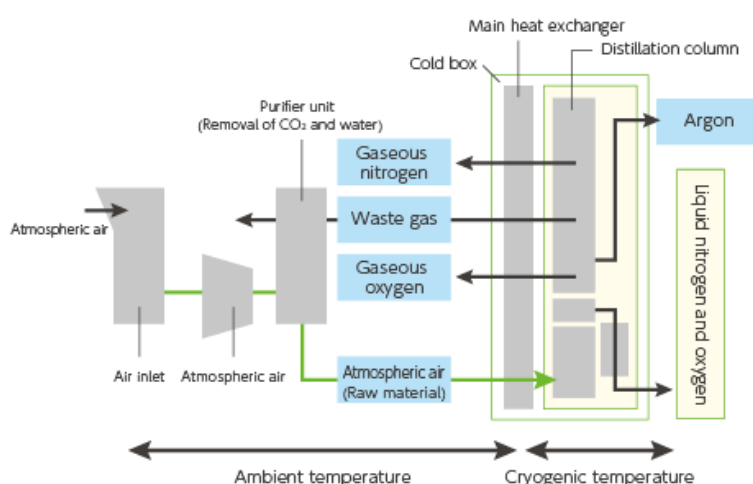
We promote a broad range of initiatives to combat climate change with the aim of helping mitigate global warming, the central theme of our environmental protection efforts. Of particular note, we are taking steps to reduce energy consumed per unit of production at gas production facilities, promoting energy-saving measures at various sites and striving to increase the efficiency of transport by tanker truck. We also promote the development of products that reduce our impact on the environment and propose solutions and contribute to global environmental conservation.

Environmental Impact of Oxygen, Nitrogen and Argon Production

The production of the Taiyo Nippon Sanso Group's core air separated gases (oxygen, nitrogen and argon) requires a considerable amount of electric power. CO₂ emissions attributable to the use of electric power used for this purpose account for approximately 98% of total Group CO₂ emissions.

Air separation units produce oxygen, nitrogen and argon simultaneously by separating atmospheric air into its constituent gases. Air is first compressed, a process that is highly energy-intensive and thus uses a significant amount of electric power. Compressed air is cooled almost to the point where the gases liquefy, after which it is ready for the distillation column, where it is separated into its gas and liquid components using a thermal distillation process. Nitrogen, which has a low boiling point, concentrates in the gas and is withdrawn from the top of the column, while oxygen, which has a higher boiling point, concentrates in the liquid and is withdrawn from the bottom of the column. Argon, which has an intermediate boiling point, is withdrawn from the middle of the column.

■ Air Separation Unit: Simplified Process Flow



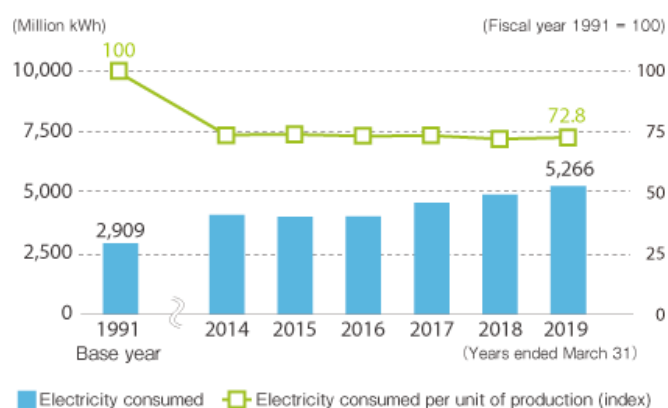
Preventing Global Warming

Our efforts to contribute to the prevention of global warming center on reducing energy consumption at gas production facilities. We have established an Energy Saving Working Group as a subsection of our Environmental Management Committee to guide these efforts. In fiscal year 2019, consumption of energy per unit of production by 2019

such facilities was up 0.2% from fiscal year 2006, the base year used for this measurement, reflecting changes in the consumption of gases supplied by pipeline by major users.

Moreover, these facilities' consumption of electric power per unit of production was down 27.2% from fiscal year 1991. Efforts by gas production facilities to reduce energy consumption included developing and installing energy-efficient air separation units, replacing air separation unit components with new high-efficiency versions and optimizing facility operations to better reflect demand. These facilities also promote initiatives in line with the Commitment to a Low-Carbon Society plan formulated by the Keidanren (Japan Business Federation) and the Japan Chemical Industry Association (JCIA)'s action plan for realizing a low-carbon society.

■ Consumption of Electricity by Gas Production Facilities in Japan



Reporting boundary: Gas production facilities belonging to and gas production companies managed by Taiyo Nippon Sanso.

Notes:

1. For information on relevant companies/departments/sites, see Environmental Data.
2. Increases in fiscal years 2018 and 2019 reflect a change in the reporting boundary to include JFE Sanso Center Co., Ltd.'s Kurashiki Plant.

■ Other Initiatives

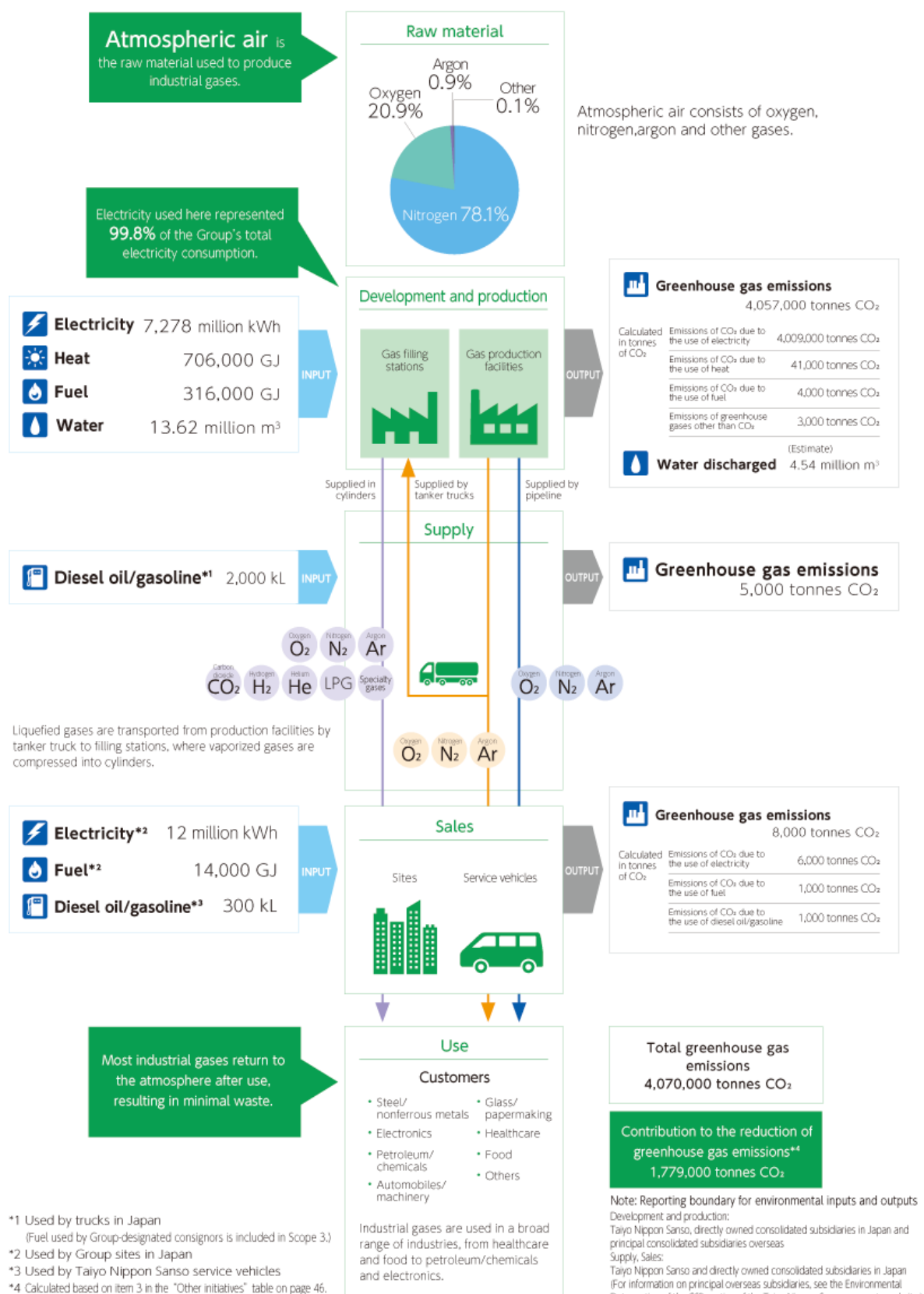
Challenges and targets	Principal initiatives	Progress as of fiscal year 2019	Relevant companies/departments/sites*1
1. Promote energy-saving measures at various sites to reduce electric power consumption (Target: Average annual reduction of 1.0% over the medium to long term)	<ul style="list-style-type: none"> ● Cut unnecessary electric power consumption by office and lighting equipment ● Replace air conditioning, OA, lighting, shared and other equipment with energy-efficient new models ● Implement no overtime days and Cool Biz (liberal summer dress code to reduce use of air conditioning) 	Down 2.1% (from fiscal year 2018)	All Taiyo Nippon Sanso sites (excluding gas production facilities)
2. Increase the efficiency of transport by tanker truck to reduce fuel used in the transport of products	<ul style="list-style-type: none"> ● Optimize shipping routes ● Rethink delivery intervals ● Promote the weighing of cargo in the presence of the customer ● Introduce new-model tanker trucks ● Reinforce green driving training 	Down 29.1% (from fiscal year 1991)	Group and subcontracted logistics companies*1
3. Contribute to environmental protection through our products by increasing sales of environment-friendly products	Take steps to bolster sales of hydrogen refueling stations, SCOPE-Jet®, MG Shield®, SF6 Recovery Service, Thermos products, nitrogen supply systems for laser processing and combustion-type gas abatement systems	Contribution to overall reduction: 1,779,000 tonnes of CO2*2	Taiyo Nippon Sanso and directly owned consolidated subsidiaries in Japan

*1 For information on relevant companies/departments/sites, see Environmental Data.

*2 Contributions to the reduction of greenhouse gas emissions were calculated in accordance with the Japanese Ministry of Economy, Trade and Industry's Guideline for Quantifying GHG Emission Reduction Contribution (formulated in March 2018).

Material Balance

■ Environmental Inputs and Outputs of the Taiyo Nippon Sanso Group's Operating Activities

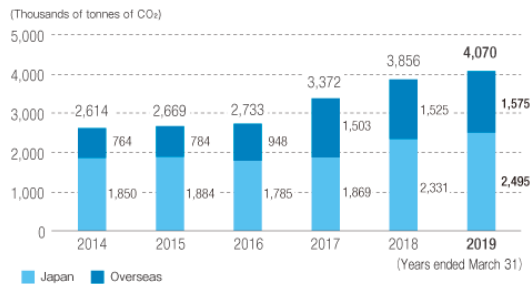


Environmental Data

We are promoting a broad range of initiatives with the aim of contributing to environmental protection.

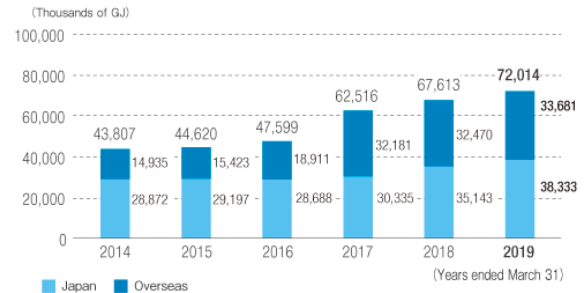
Greenhouse Gases and Energy

Greenhouse Gas Emissions (Scope 1 and Scope 2)



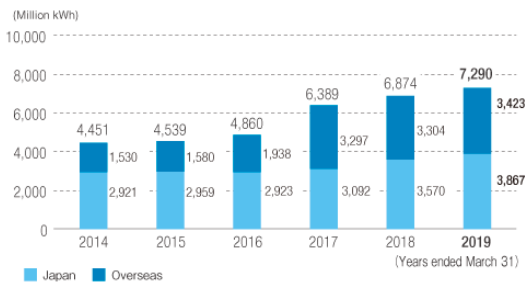
Reporting boundary: Taiyo Nippon Sanso, directly owned consolidated subsidiaries in Japan and principal consolidated subsidiaries overseas.

Energy Consumption



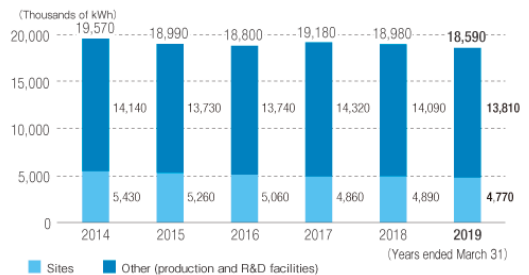
Reporting boundary: Taiyo Nippon Sanso, directly owned consolidated subsidiaries in Japan and principal consolidated subsidiaries overseas.

Electric Power Consumption



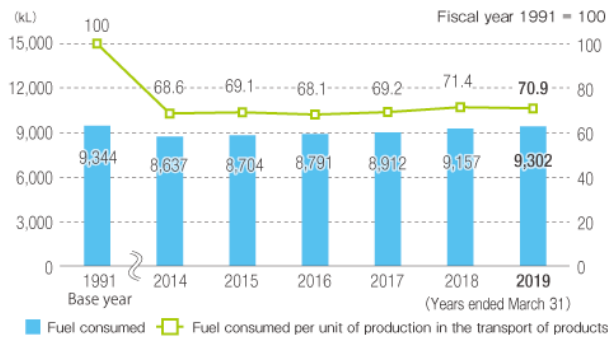
Reporting boundary: Taiyo Nippon Sanso, directly owned consolidated subsidiaries in Japan and principal consolidated subsidiaries overseas.

Electric Power Consumed by Sites



Reporting boundary: Taiyo Nippon Sanso sites (excluding gas production facilities)

■ Fuel Consumption by Tanker Trucks and Fuel Consumption per Unit of Production for the Transport of Products



Reporting boundary: Taiyo Nippon Sanso Group and principal subcontracted logistics companies

Notes:

1. Taiyo Nippon Sanso Group logistics companies: Kyushu Ekiso Co., Ltd., Kouei Circulation Co., Ltd., Taiyo Ekiso Co., Ltd., Nissan Unyu K.K.

Principal subcontracted logistics companies: Art Konpoh Transportation Co., Ltd., SII Logistics Inc., Ekiso Co., Ltd., Eto Unyu Co., Ltd., Ookawa Unyu Co., Ltd., Kanagawa Sangyo Co., Ltd., Kotobuki Unso Co., Ltd., Tatsumi Shokai Co., Ltd., Chiba Ekiso Co., Ltd., Tokai Unyu Construction Co., Ltd., Tohshin Sangyo Co., Ltd., Naruse Sanso Unyu Co., Ltd., Nishinohon Maruesu Co., Ltd., Niyac Corporation, Marusan Unyu Co., Ltd.

2. Fuel consumption in the fiscal year 1991 base year was for Taiyo Nippon Sanso predecessor Nippon Sanso Corporation.

SF6 Recovery Service (Taiyo Nippon Sanso Higashikanto Corporation)

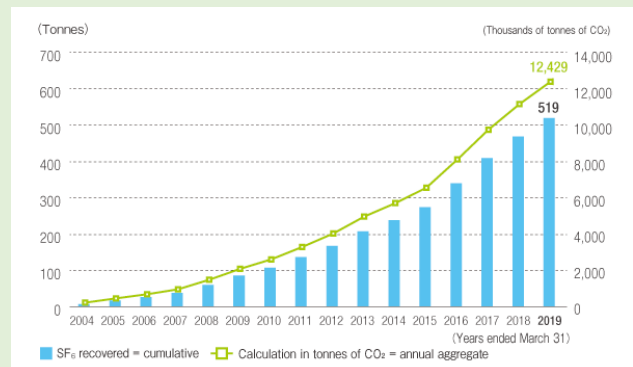
Taiyo Nippon Sanso Higashikanto Corporation provides the SF6 Recovery Service. An integrated service encompassing the recovery, reuse and detoxification of sulfur hexafluoride (SF6), a potent greenhouse gas, the SF6 Recovery Service capitalizes on proprietary technologies and is offered to customers across Japan. This is a key example of our efforts to fully leverage our technologies to help achieve zero emissions of greenhouse gases and, in so doing, to contribute to global environmental conservation.

In fiscal year 2005, Taiyo Nippon Sanso Higashikanto received a special jury award in the Ozone Layer Protection and Global Warming Prevention Awards.



SF6 recovery equipment

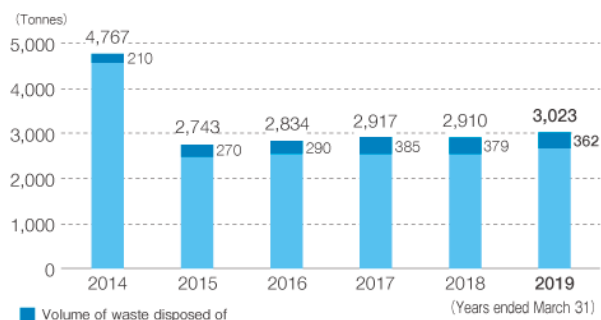
■ SF6 Recovered and Tonnes of CO2 Equivalent



Taiyo Nippon Sanso Higashikanto website: <https://www.tnhk.co.jp/> (available in Japanese only)

Waste

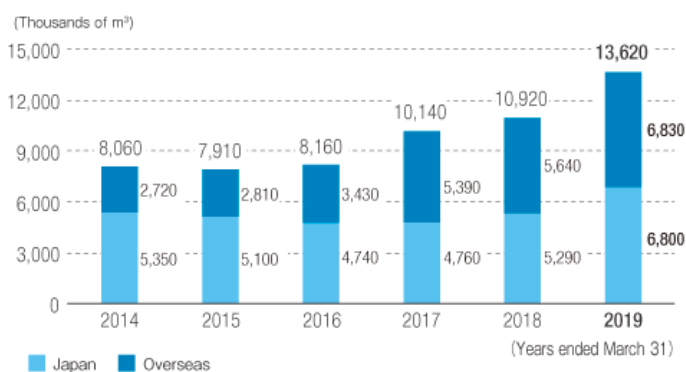
■ Industrial Waste Discharged



Reporting boundary: Taiyo Nippon Sanso and directly owned consolidated subsidiaries in Japan.

Water

■ Fresh Water Withdrawn



Reporting boundary: Gas production facilities of Taiyo Nippon Sanso and directly owned consolidated subsidiaries in Japan, and principal consolidated subsidiaries overseas.

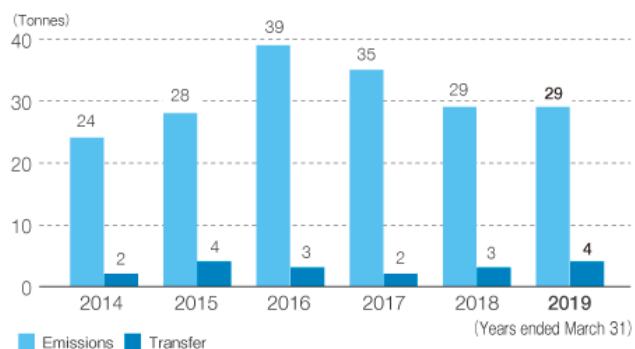
Pollutant Release and Transfer Register (PRTR)-Designated Substances

■ Emissions and Transfer of PRTR-Designated Substances in Fiscal Year 2019

(kg)

Substance	Emissions	Transfer	Substance	Emissions	Transfer
Ethylene oxide	33	0	Dichloromethane	4,750	2,000
Nickel compounds	0	92	Selenium and its compounds	0	67
Arsenic and its inorganic compounds	0	199	Trichlorofluoromethane (CFC-11)	464	0
Ethylbenzene	1,059	150	Toluene	807	21
Ferric chloride	0	462	Nickel	1	9
Xylene	2,883	21	1-bromopropane	6,242	0
Chromium and chromium (III) compounds	5	77	n-hexane	0	156
Chlorodifluoromethane (HCFC-22)	2,847	490	Boron and its compounds	0	99
Chloroform	0	101	Manganese and its compounds	6	51
1,3-dioxolane	242	0	Methylnaphthalene	4	0
Dichloropentafluoropropane (HCFC-225)	10,120	0	Total	29,463	3,995

■ Emissions and Transfer of PRTR-Designated Substances



Reporting boundary: Taiyo Nippon Sanso and directly owned consolidated subsidiaries in Japan.

Environmental Accounting

■ Environmental Protection Costs

(Millions of yen)

Category	Principal initiatives	Fiscal year 2017		Fiscal year 2018		Fiscal year 2019	
		Investment	Expenses	Investment	Expenses	Investment	Expenses
Pollution prevention costs	Installation and maintenance of abatement systems; maintenance of purification tanks; purchase of tanker trucks	118	130	119	137	104	144
Global environmental conservation costs	Introduction of energy-saving air separation units Introduction and maintenance of low-emissions vehicles	5,133	125	11,527	171	9,516	116
Resource recycling costs	Disposal/recycling of waste; recovery/disposal of used absorbent agents from customers	0	54	0	53	0	57
Upstream/downstream costs	Green procurement	0	25	0	23	0	23
Administrative costs	Expenses involved in environmental management system administration	0	74	0	75	0	75
R&D costs	R&D for environment-friendly products	72	395	94	270	35	424
Community activity costs	Environmental protection; beautification; landscaping and other improvements; cleanup of areas surrounding sites	0	4	0	3	0	4
Environmental remediation costs		0	0	0	0	0	0
	Total	5,323	807	11,740	732	9,655	844

■ Environmental Protection Benefits

(Millions of yen)

	Benefits	Fiscal year 2017	Fiscal year 2018	Fiscal year 2019
Profit	Profit attributable to the recycling of waste from principal business activities	11	12	12
Reduction in expenses	Reduction in energy expenses achieved through energy conservation initiatives	3	1,363	4
	Total	14	1,375	15

Reporting boundary: Taiyo Nippon Sanso and four consolidated subsidiaries in Japan (Japan Fine Products Co., Ltd.; Taiyo Nippon Sanso Engineering Corporation; Nissan Unyu K.K. and Thermos K.K.)

Reporting boundary

Gas Production Companies Managed by Taiyo Nippon Sanso

Akita Ekisan Kogyo Co., Ltd.; Iwaki Sanso Center Co., Ltd.; Oita Sanso Center Co., Ltd.; K.K. Kameyama Gas Center; Kita Nihon Sanso Corporation; Kyushu Cryogenics Co., Ltd.; Kyokuyo Semiconductors Co., Ltd.; Sakai Gas Center Co., Ltd.; JFE Sanso Center Co., Ltd.; Shikoku Ekisan Co. Ltd.; Shunan Sanso Co., Ltd.; Shin Sagami Sanso Co., Ltd.; Shin Nanyo Sanso Co., Ltd.; Shinyo Sanso Co., Ltd.; Sendai Sanso Center Co., Ltd.; Taiheiyo Gas Center Co., Ltd.; Taiyo Nippon Sanso Higashikanto Corporation; Chiba Sanso Center Co., Ltd.; Tsurusaki Sanso Center Co., Ltd.; TM Air Co., Ltd.; Nagoya Sanso Center Co., Ltd.; Hakodate Sanso Corporation; Fuji Sanso Co., Ltd.; Yahata Sanso Center Co., Ltd.

Taiyo Nippon Sanso Group Logistics Companies

Kyushu Ekiso Co., Ltd.; Koei Unyu Co., Ltd.; Taiyo Ekiso Co., Ltd.; Nissan Unyu K.K.

Principal Subcontracted Logistics Companies

Principal subcontracted logistics companies: Art Konpoh Transportation Co., Ltd., SEE Logistics Inc., Ekiso Co., Ltd., Eto Sanso Co., Ltd., Ookawa Unyu Co., Ltd., Kanagawa Sangyo Co., Ltd., Kotobuki Unso Co., Ltd., Tatsumi Shokai Co., Ltd., Chiba Ekiso Co., Ltd., Tokai Unyu Kensetsu K.K., Tohshin Sangyo Co., Ltd., Naruse Sanso Unyu Co., Ltd., Nishinohon Maruesu Co., Ltd., Niyac Corporation, Marusan Unyu Co., Ltd.

Principal Overseas Consolidated Subsidiaries

Matheson Tri-Gas, Inc.; Leeden National Oxygen Ltd.; Ingasco, Inc.; Taiyo Nippon Sanso Philippines, Inc.; Taiyo Nippon Sanso Clark Inc.; Air Products Industry Co., Ltd.; Taiyo Gases Co., Ltd.; Vietnam Japan Gas Joint Stock Company; Taiyo Nippon Sanso India Pvt. Ltd.; Shanghai Taiyo Nippon Sanso Gas Co., Ltd.; Suzhou Taiyo Nippon Sanso Gas Co., Ltd.; Dalian Chanching Island Taiyo Nippon Sanso Gas Co., Ltd.; Dalian Taiyo Nippon Sanso Gas Co., Ltd.; Yangzhou Taiyo Nippon Sanso Gas Co., Ltd.; Taiyo Nippon Sanso Taiwan, Inc.; Taiyo Nippon Sanso Engineering Taiwan, Inc.; Fy Yang Gas Co., Ltd.; Supagas Pty Ltd

Developing Environment-Friendly Products

We capitalize on gas control technologies cultivated over many years to promote the development of products that reduce our impact on the environment and propose solutions and contribute to global environmental conservation.

Products that Contribute to the Reduction of Energy Consumption and CO₂ Emissions

Reduction of energy consumption Reduction of air pollution

We promote the development of oxygen combustion technologies for a broad range of applications, contributing to the reduction of energy consumption and emissions of substances harmful to the environment. For example, we have developed a combustion technology whereby high-purity oxygen is added to atmospheric air, increasing the oxygen concentration to 21% or higher, which boosts combustion efficiency. This facilitates a higher burner flame temperature while at the same time lowering the concentration of NO_x, thereby reducing NO_x in emissions and thermal losses. A variety of applications are being explored for this as a technology contributes to the reduction of both energy consumption and CO₂ emissions, including high-temperature heating furnaces and melting furnaces.



The Innova-Jet® Swing burner direct flames efficiently and evenly over a wide area via self-induced oscillation.

This achievement has its origins in an oxygen burner technology introduced from U.S. firm Air Reduction Company in 1970 in which fuel (mainly heavy oil) and oxygen were injected into a nozzle tip, diffused and combusted. Attaching a nozzle and oxygen burner to a smelting or sintering furnace thus made it possible to improve productivity. In the United States, the technology was commonly used in aluminum smelting, but in Japan it first became popular as a way to reduce energy consumed by electric furnaces, after which use expanded to include other industrial furnaces, including aluminum melting furnaces, refractory cement melting furnaces and aluminum oxide kilns. We have responded by developing a lineup of products suited to diverse needs, including the SCOPE-Jet® swing burner, which substantially reduces power consumption, and Innova-Jet®, which achieves a significant reduction in NO_x generation during oxygen-enriched combustion.

NeoKelvin®-Turbo 10 kW Large-Capacity Turbo-Brayton Refrigerator for Superconducting Power Cables

Reduction of energy consumption

In the area of superconducting power cables, practical development is expected to yield benefits in the form of a stable power grid and reduced costs. Of particular note, efforts to achieve commercialization are progressing overseas, fueled by growing demand for electric power. In response to rising needs, in May 2013 we launched the NeoKelvin®-Turbo 2 kW, a Turbo-Brayton refrigerator developed specifically for this application that uses neon gas as a refrigerant. In July 2016, we commenced sales of NeoKelvin®-Turbo 10 kW, a large-capacity Turbo-Brayton

refrigerator.

While NeoKelvin®-Turbo 2 kW is only capable of cooling test-scale superconducting power cables several hundred meters long, NeoKelvin®-Turbo 10 kW facilitates the cooling of cables upwards of 1.0 km. A prototype of the NeoKelvin®-Turbo 10 kW is currently being used to cool cables in a superconducting power cable verification test being conducted jointly by Korea Electric Power Corporation and LS Cable & System Ltd. on the Korean island of Cheju. In July 2019, actual transmission of electric power through these cables began, marking the first time a Turbo-Brayton refrigerator has been used commercially for cooling superconducting power cables.



The NeoKelvin®-Turbo 10 kW Turbo-Brayton refrigerator

Energy-Efficient Ultralarge-Scale Air Separation Unit

Reduction of energy consumption

Air separation units take in atmospheric air and produce gases, notably oxygen and nitrogen, through liquefaction and separation. Our ultralarge-scale air separation unit offers distinct advantages over its predecessors in terms of energy efficiency, reducing energy consumption per unit of gas produced by approximately 15%. This accomplishment reflects three key improvements:

1. Increased operating efficiency, achieved by boosting the size of the unit as a whole and of the air compressor;
2. Reduced air compressor power requirements, attributable to the use of a low pressure-loss packed column; and
3. Reduced air compressor energy consumption, a result of the use of a downflow condenser reboiler.



Ultralarge-scale air separation unit

Nitrocube® RE-LT Series of High-Performance PSA Nitrogen Generators

Reduction of energy consumption

Pressure-swing adsorption (PSA) nitrogen generators capitalize on differences in the properties of the adsorbent used to continuously extract nitrogen while alternately pressurizing and depressurizing compressed air. In addition to achieving performance improvements by modifying our in-house adsorbent technologies and by combining a newly developed proprietary gas separation process with a control technology that optimizes the action of the compressor in accordance with the amount of nitrogen generated, we succeeded in reducing energy consumption. Thanks to these energy-saving technologies, Nitrocube® RE-LT series' PSA nitrogen generators are eligible for a tax scheme in Japan designed to help strengthen small and medium-sized enterprises.



LT-F nitrogen supply system for laser cutting machines

JN Series and MG Series of Nitrogen Generators

Reduction of energy consumption

Reduction of air pollution

Reduction of noise and vibration

We install nitrogen generators at the sites of customers that consume a large volume of nitrogen. We use an environment-friendly production process that unlike conventional processes does not require the use of chlorofluorocarbon refrigerators. The JN series of nitrogen generators are standardized units with advanced noise reduction features. Thanks to process modification, the MG series delivers increased nitrogen yield, achieving a reduction in energy consumption per unit of gas produced of approximately 20%. We also provide high-volume supply systems that achieve a reduction of approximately 30%.



Nitrogen generator

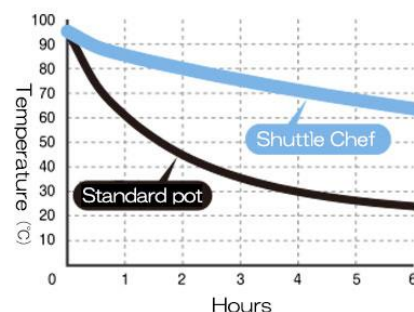
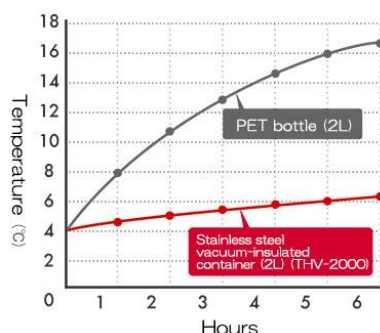


Vacuum-Insulated Products

Reduction of energy consumption

The Thermos business of subsidiary Thermos K.K. dates back to 1978 and capitalized on its vacuum insulation technologies to develop the world's first vacuum-insulated stainless steel bottle. The Thermos lineup also includes portable vacuum insulated mugs for hot and cold beverages and sports-use vacuum-insulated beverage bottles, as well as the Shuttle Chef series of vacuum-insulated thermal cooking pots, all of which have earned certification under Japan's Eco Mark system. In line with its goal of providing solutions that enhance lifestyles and are environment-friendly, Thermos continues to promote the development of a variety of products that reduce resource use and contribute to environmental protection.

■ Cold Retention: Vacuum-Insulated Container vs. PET Bottle ■ Heat Retention: Shuttle Chef vs. Standard Pot



Shuttle Chef Components

Hydro Shuttle® Package-Type Hydrogen Refueling Station

Prevention of global warming Reduction of air pollution

The **Hydro Shuttle®** package-type hydrogen refueling station integrates the four major components of a hydrogen refueling station-dispenser, pre-cooler, hydrogen compressor and storage into a single unit. These compact (9m × 2m × 2.6m) units can be used not only as permanent stations, but also as truck-mounted mobile stations. The package format significantly reduces the cost of installation, while the simplification of components means the cost of fabrication is only half that of conventional permanent stations. Because it can be used as a mobile station, a single Hydro Shuttle® offers promise for multiple applications, including on-site stations equipped with hydrogen production facilities, off-site stations that supply hydrogen produced at facilities elsewhere and travelling stations that transport hydrogen from one location to another.



Hydro Shuttle®
hydrogen refueling station
mounted on a truck

In December 2017, we opened Nimohys Hydrogen Station Setagaya, operated by Nippon Mobile Hydrogen Station Services, LLC (nicknamed “Nimohys”), in Tokyo. This is our second such station, joining Nimohys Hydrogen Station Minami-Rokugo in the city’s Ota ward. Looking ahead, we will continue to promote the establishment of additional stations.

Biogas Refining Units

Prevention of global warming

Our biogas refining units, which employ ordinary-pressure regenerative PSA, are capable of increasing the purity of methane gas to 98% or higher. We recently developed a low-cost compact unit suitable for the small- and medium-scale decentralized biogas plants used by dairy farmers and food processing factories. Because high-purity methane gas separated and refined from biogas is suitable for applications that conventionally depend on city gas, it offers promise as carbon-neutral energy that can be produced locally for local consumption. In Japan, tests are currently under way to determine the feasibility of supplying methane produced from biogas and city gas using the same distribution networks, underscoring the potential of biogas-derived methane to contribute to environmental preservation.



Biogas refining unit

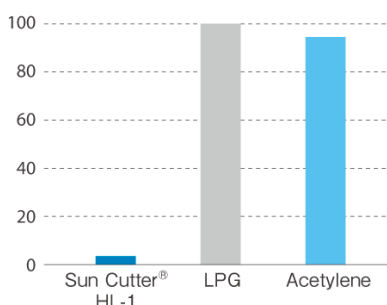
Sun Cutter® HL-1 Gas Cutting Fuel Gas

Prevention of global warming

Gas cutting is a process that uses fuel gases and oxygen to cut steel. We have developed and launched Sun

Cutter® HL-1, a flammable gas for this application, the principal component of which is hydrogen. Because it emits almost no CO₂, Sun Cutter® HL-1's environmental impact is minimal. It also enhances work environments by suppressing radiant heat. It also delivers an excellent cutting performance thanks to a cutting speed 1.4 times faster than existing products, lower thermal distortion and improved cut surface quality.

■ Index of CO₂ Emissions (LPG=100)



Sun Cutter® HL-1

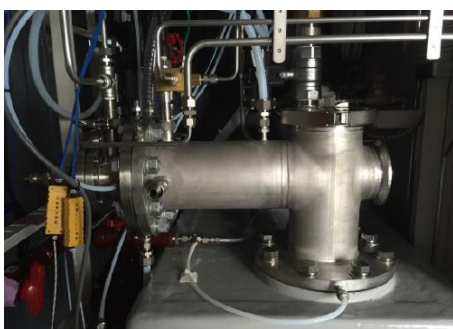


Cutting steel with Sun Cutter® HL-1

New Compact Combustion-Type Exhaust Gas Abatement System

Prevention of global warming Reduction of air pollution

Fuel-powered combustion-type exhaust gas abatement systems contribute to the prevention of global warming and reduced environmental impact by efficiently decomposing perfluorocarbon (PFC) gases used in electronics manufacturing, which have a long atmospheric lifetime. Leveraging related combustion technologies, we developed a new burner that can be installed near the dry pump outlet downstream in the chemical vapor deposition (CVD) system that isolates chambers, reducing the need for previously essential nitrogen and exhaust piping for exhaust gas dilution. By reducing necessary utilities, this unit achieves a reduction in CO₂ emissions attributable to exhaust gas abatement systems of 50%60% compared with existing offerings.



New compact combustion-type exhaust gas abatement system: Exterior of burner



New compact combustion-type exhaust gas abatement system: Flames in burner

NACS HEAT® Liquefied Gas Cylinder Heating System

Prevention of global warming Reduction of air pollution

We recently added NACS HEAT®, a liquefied gas cylinder heating system for use with our U-NACS II automated cylinder cabinet. This energy-efficient system achieves significantly higher energy conversion efficiency than conventional systems using heating blankets or jacket heaters, the new system. In addition, an interlock function that links the system to the cabinet itself ensures a safe and stable supply.

Comparison with conventional systems

- Electric power consumption: -50%
- Facility costs: -50%
- Supply capacity: 2-3 times
- Space required: -30%



NACS HEAT® used with a 1,860-liter cylinder



Installing NACS HEAT® on a 47-liter cylinder