JSR Corporation

PLANT OUTLINE

Sustainable growth by providing indispensable materials to society

JSR Corporation (formerly 'Japan Synthetic Rubber Co., Ltd.') was established in 1957 for domestic production of synthetic rubbers. Since then, JSR has continuously expanded its business to emulsions, plastics and other materials for the semiconductor, flat panel display, and optical materials fields by leveraging our proprietary polymer technologies. The development of these advanced materials for the information and electronics fields has served as a gateway to innovative changes to the company's business structure.

In the new mid-term business plan “JSR20i9”, which started in April 2017, we adopted “Strengthening Competitiveness for the future” as a mission. We will focus on earnings drivers and profit expansion in SSBR, semiconductor materials and the Life Sciences Business. We will also work on improving productivity and strengthening our competitiveness through digitalization.

JSR Group's Corporate Mission is "Materials Innovation: We create value through materials to enrich society, people and the environment". We will pursue the possibilities that materials represent, creating value that will make the world around us a better place to live and work.*

* “JSR20i9” (twenty-nineteen) emphasizes the “Innovation” to realize Materials Innovation, which is the heart of our corporate mission.

Outline of JSR

Major Businesses

ELASTOMERS BUSINESS

We have been providing an extensive range of products such as synthetic rubbers for car tires, thermoplastic elastomers with the characteristics of both elastomers and plastics, and latex for paper coating.

PLASTICS BUSINESS

JSR Group has a wide range of ABS resins with unique features derived from the technological competence of flexible product design.
Our ABS resins are widely used for automobiles, household electric appliances, building materials, etc.

DIGITAL SOLUTIONS BUSINESS

Semiconductor Materials

We provide a comprehensive range of materials that facilitate small-patterning and integration in various manufacturing processes for cutting-edge semiconductors, including lithography materials (photoresists, multilayer materials), CMP (Chemical Mechanical Planarization) materials and more.

Display Materials

We are one of the world's top manufacturers of many materials used in color liquid-crystal panels in smartphones, tablet PCs, LCD televisions, and other products. We are particularly strong in cutting-edge products for high definition as well as high-performance products for small- to medium-sized panels.

Edge Computing Related Items

We develop and market optical components used in smartphones, tablet PCs, LCD televisions, and other products and 3D modeling systems.

LIFE SCIENCES BUSINESS

We supply bioprocess materials, materials for diagnostic and research reagents, and services to support drug discovery, development and manufacturing that precisely meet our customers' needs for biopharmaceuticals and other advanced therapies.

OTHER BUSINESSES

Among other activities, we conduct next-generation research as well as supply lithium-ion capacitors, which are electrical storage devices that enable effective use of energy.

Connection between Petrochemical Complex and JSR

Crude oil is refined at petroleum refining companies, and it becomes petroleum products such as naphtha, kerosene, light oil, heavy oil, LPG (liquefied petroleum gas), etc.
Naphtha is a mixture of various hydrocarbons and this becomes a starting material for the petrochemical industry.
If thermal cracking is conducted on the naphtha at high temperature, it will produce ethylene propylene C_4 fractions, C_5 fractions and cracked oil. These chemicals are referred to as the building blocks of the petrochemical industry. Using these chemicals as raw materials, all sorts of derivatives are produced.
JSR receives supplies of ethylene, propylene, styrene, acrylonitrile, C_4 fractions, and produces various products from these raw materials.

Activities for Environment and Safety

As a company that stresses corporate social responsibility (CSR), JSR takes an active stance with respect to the environment and safety. In recent years, we have committed to create benefits for both society and the company and to contribute to the realization of a sustainable global environment and society. Thus, since 1995, we have been promoting independent and self-managed activities designed to proactively conserve the global environment and to maintain and improve safety and health as part of our Responsible Care program. At the same time, we are endeavoring to develop business establishments that earn even greater trust by building communication with local communities and petrochemical complexes through various activities. We will remain focused on realizing a sustainable global environment and society by continuously improving these initiatives.

Capacity

(As of April 1, 2019, Unit: tons / year)

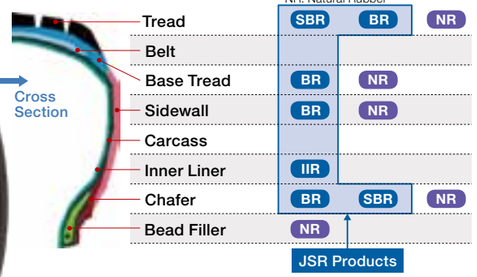
Products	Yokkaichi plant	Chiba plant	Kashima plant	Others	Total
SBR (including NBR, HSR)	255,000				255,000
Latex	120,000				120,000
BR		72,000			72,000
Solution SBR, Hydrogenated Polymer	70,000			100,000 (Thailand)*1	170,000
IR			41,000		41,000
EP			36,000	220,000 (Korea)*2	256,000
IIR				98,000 (Kawasaki)*3	98,000
H-IIR			80,000 *3		80,000
RB		24,000			24,000
ABS resin, AS resin	250,000 *4			150,000 (Ube, Otake)*4	400,000
ARTON		5,000			5,000
Butadiene	148,000	130,000	120,000		398,000
Isoprene			36,000		36,000
WSP			1,200		1,200

Notes: *1 JSR BST Elastomer Co., Ltd. *2 Kumho Polychem Co., Ltd. *3 Japan Butyl Co., Ltd. *4 Techno-UMG Co.,Ltd.

Major Products and Applications

Elastomers Business

TIRES



*NR: Natural Rubber

	SBR	BR	NR
Tread	SBR	BR	NR
Belt			
Base Tread	BR	NR	
Sidewall	BR	NR	
Carcass			
Inner Liner	IIR		
Chafer	BR	SBR	NR
Bead Filler	NR		

JSR Products

SBR Series

SSBR (Solution Polymerization Styrene-Butadiene Rubber)
1) Features: Low rolling resistance while retaining wet grip
2) Applications: High performance and fuel-efficient tires
3) Production: JSR Yokkaichi Plant etc.

ESBR (Emulsion Polymerization Styrene-Butadiene Rubber)
1) Features: Typical type general purpose rubber with well-balanced properties.
2) Applications: General tires
3) Production: JSR Yokkaichi Plant

IIR (Butyl Rubber)
1) Features: Good impermeability
2) Applications: Inner liner for tires
3) Production: Japan Butyl Co. Ltd.

IR (Isoprene Rubber)
1) Features: Equivalent to NR (Natural Rubber)
2) Applications: Tires
3) Production: JSR Kashima Plant

BR (Polybutadiene Rubber)
1) Features: High tensile strength
2) Applications: Tires
3) Production: JSR Chiba Plant

AUTOMOBILES

EP (Ethylene Propylene Rubber)
1) Features: Good heat and weather resistance
2) Applications: Window seals, water hoses, wire coating materials, etc.
3) Production: JSR Kashima Plant, etc.

NBR (Nitrile Rubber)
1) Features: Good oil resistance
2) Applications: Fuel hoses, oil seals, etc.
3) Production: JSR Yokkaichi Plant

EXCELINK™ (Thermoplastic Elastomer)
1) Features: Easy to form shapes, has properties in between those of synthetic rubber and plastic
2) Applications: Corner materials of window seals
3) Production: JSR Yokkaichi Plant

OTHERS

RB (Syndiotactic 1,2-polybutadiene)
1) Features: Good outlook and skid resistance
2) Applications: Footwear soles, medical tubes
3) Production: JSR Chiba Plant

TR (Styrene Butadiene Thermoplastic Elastomer)
1) Features: Good shock resistance
2) Applications: Food trays, flexographic printing, asphalt modification
3) Production: Kraton JSR Elastomers K.K.

DYNARON™ (Hydrogenated Polymer)
1) Features: Good compatibility with polyolefin
2) Applications: Adhesive layers of optical films
3) Production: JSR Yokkaichi Plant

SIS (Styrene Isoprene Thermoplastic Elastomer)
1) Features: Superior adhesive strength
2) Applications: Adhesive, plaster
3) Production: Kraton JSR Elastomers K.K.

Paper Coating Latex
1) Features: Excellent binding strength, ink receptability
2) Applications: Paper coatings
3) Production: JSR Yokkaichi Plant

Styrene Butadiene Latex
1) Features: Superior adhesive strength
2) Applications: Industrial adhesives
3) Production: JSR Yokkaichi Plant

Acrylic Emulsions
1) Features: Enables to design flexibly for required needs
2) Applications: Adhesive, paintings, floor polishes, etc.
3) Production: EMULSION TECHNOLOGY Co., Ltd.

SIFCLEAR™
1) Features: Stain resistance and excellent durability
2) Applications: Painting
3) Production: EMULSION TECHNOLOGY Co., Ltd.

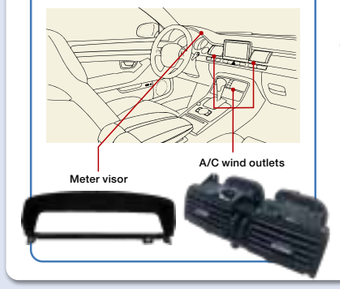
Binders for Batteries
1) Features: Improves battery performance
2) Applications: Li-ion secondary batteries
3) Production: JSR Yokkaichi Plant

Plastics Business

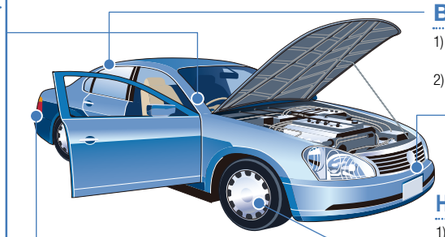
3) Production: Techno-UMG Co.,Ltd.

AUTOMOBILES

HUSHLLOY™
1) Features: Reduces squeaky noise from plastic joints
2) Applications: Automobile interior parts



ABS Resin



Blow Grade
1) Features: Easy to mold large, hollow parts
2) Applications: Spoilers

Plating and Painting Grade
1) Features: Suitable for plating and painting
2) Applications: Front Grill

Heat and Flame resistant Grade
1) Features: Good heat and flame resistance
2) Applications: Automobile interior parts such as switch

Weather-resistant Grade
1) Features: Good heat and weather resistance
2) Applications: Rear lamps

Alloy Grade
1) Features: Good shock resistance and easy to plate and paint
2) Applications: Wheel covers

Digital Solutions Business

3) Production: JSR Yokkaichi Plant etc.

SEMICONDUCTORS

Front-end

Back-end

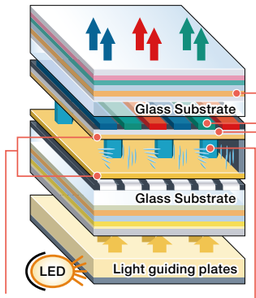
Lithography Materials (Photoresist, Multi-layer)
1) Features: Enables critical, cutting-edge semiconductor manufacturing
2) Applications: Front-end semiconductor processes

Process Materials (CMP Slurry, Cleaning Solutions)
1) Features: Wide product portfolio for advanced semiconductor processes
2) Applications: Front-end semiconductor processes

Advanced Packaging Materials (Thick layer photoresists, Insulation materials)
1) Features: Various products for advanced packaging such as fanout, 3D packaging
2) Applications: Back-end semiconductor processes

FLAT PANEL DISPLAYS

Basic structure of color LCD



Retardation Films (Optical Materials)
1) Features: ARTON™ has excellent optical characteristics, heat resistance, film adhesion, mold-ability and chemical resistance

Color Pigmented Resists
1) Features: Excellent developing performance and good tapered profiles

Protective Coating
1) Features: Good thermal stability, transparency and excellent surface flatness

Alignment Films
1) Features: Good crystal alignment and consistent pre-tilt angles, as well as excellent voltage retention and residual DC characteristics

Photosensitive Spacers
1) Features: Good thermal resistance, transparency and mechanical strength

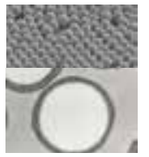
Life Sciences Business

3) Production: JSR Life Sciences Corporation, MEDICAL & BIOLOGICAL LABORATORIES CO., LTD., KBI Biopharma Inc. etc.

Amsphere™ A3
1) Features: A high capacity, next generation Protein A chromatography resin for advanced antibody purification
2) Applications: Affinity chromatography in a downstream processing of therapeutic antibody drug manufacturing

ExoCap™
1) Features: Enables easier and purer isolation of exosomes
2) Applications: Basic research for diagnostics

Magnosphere™
1) Features: A series of superparamagnetic micro particles
2) Applications: Diagnostic agents. Also used in ExoCap™

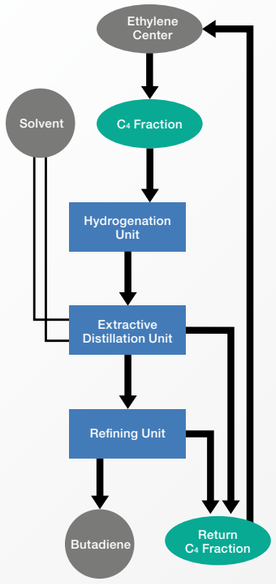


Manufacturing Process of Major Products

Elastomers Products

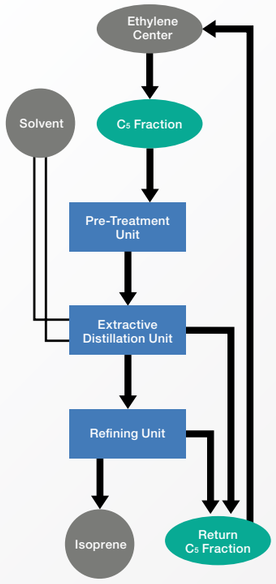
Butadiene

Butadiene is produced at the ethylene plant as a byproduct of C_4. Butadiene is typically isolated from the other four-carbon hydrocarbons produced in steam cracking by extractive distillation using a polar aprotic solvent, from which it is then stripped by distillation. It is an important industrial chemical used as a monomer for the production of synthetic rubber.



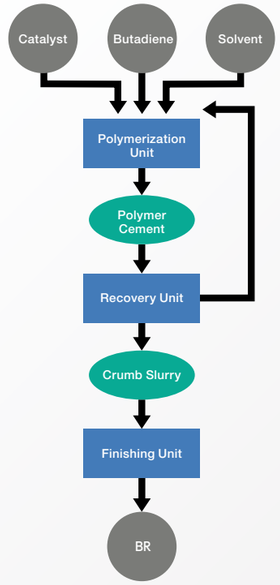
Isoprene

Isoprene is produced at the ethylene plant as a byproduct of C_5. Isoprene is isolated from the other five-carbon hydrocarbons produced in steam cracking by extractive distillation using a polar aprotic solvent, from which it is then stripped by distillation. It is used to produce synthetic version of natural rubber.



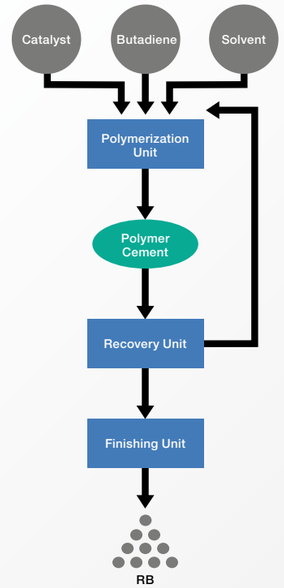
BR (Polybutadiene Rubber)

The base material is butadiene. Solvent is added to butadiene and an organic metal compound is used as a catalyst for solution polymerization. Unreacted butadiene and solvent is collected from this polymer solution. Rubber is dehydrated, dried, measured and molded before it is packed and shipped out.



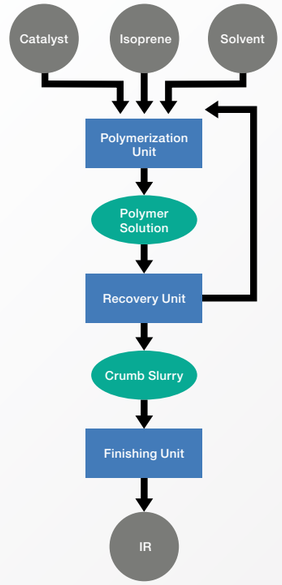
RB (syndiotactic 1,2-polybutadiene)

The base material is butadiene. An organic metal compound is used as a catalyst for solution polymerization to produce RB. Unreacted butadiene and solvent is collected from this polymer solution. RB will be extrusion pelletized than packed and shipped out.



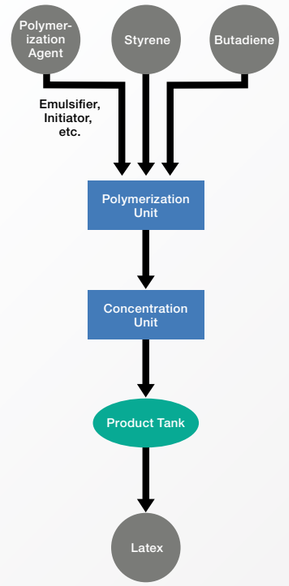
IR (Isoprene Rubber)

The base material is isoprene. Solvent is added and an organic metal compound is used as a catalyst for solution polymerization. Unreacted isoprene is collected from the polymer solution. Rubber is dehydrated, dried, measured and molded before it is packed and shipped out.



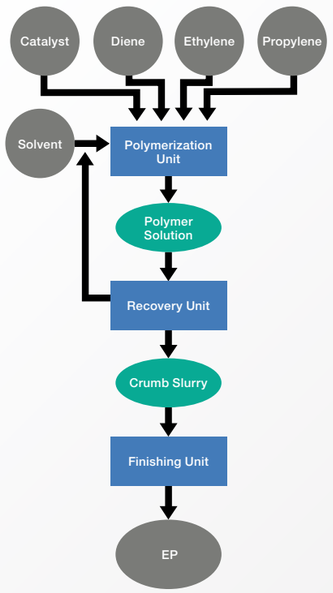
Latex

The base materials are butadiene, styrene and other monomers. Water, emulsion, initiator, etc. are added and polymerized until a certain reaction rate is reached by emulsion polymerization. Unreacted butadiene and styrene are collected and will be used for latex. This latex will be enriched and emulsified.



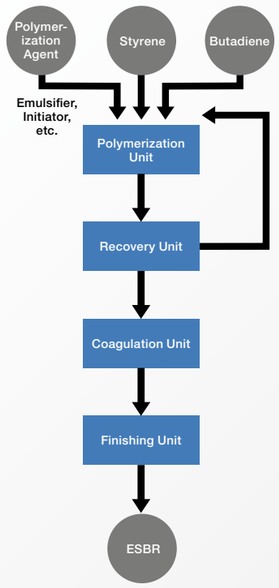
EP (ethylene propylene rubber)

The base materials are ethylene, propylene and diene. Solvent is added and an organic metal compound is used as a catalyst for solution polymerization to produce EP. Unreacted monomer and solvent is collected from this polymer solution. Rubber will be dehydrated, dried, measured, packed and shipped out.



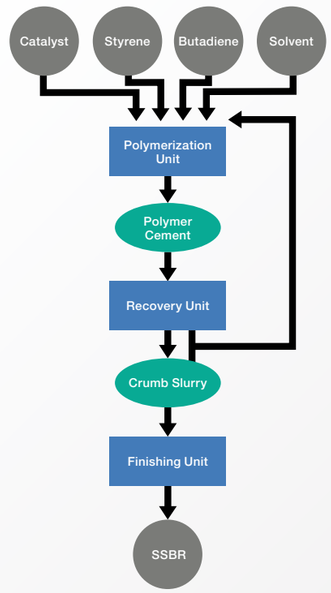
ESBR (Emulsion Polymerization Styrene-Butadiene Rubber)

The base materials are butadiene and styrene. Water, emulsion, initiator, etc. are added and polymerized until a certain reaction rate is reached by emulsion polymerization. Unreacted butadiene and styrene are collected and will be used for latex. Antioxident and extension oils are added to this latex, and solidified, dehydrated, dried, measured, packed and shipped out.



SSBR (Solution Polymerization Styrene-Butadiene Rubber)

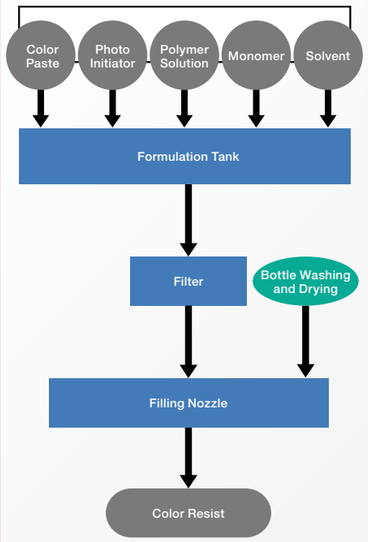
The base materials are butadiene and styrene. Solvent is added to butadiene and an organic metal compound is used as a catalyst for solution polymerization. Unreacted butadiene and solvent is collected from this polymer solution. Rubber is dehydrated, dried, measured and molded before it is packed and shipped out.



Digital Solutions Products

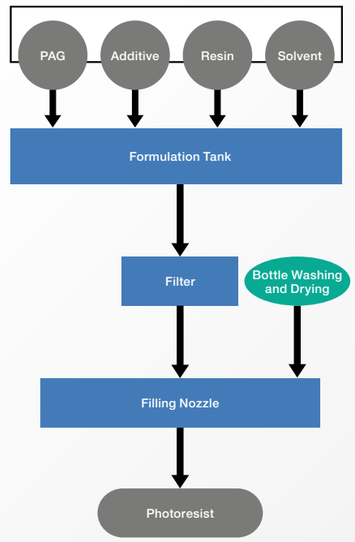
Color Pigmented Resist (Display Materials)

Acrylic resin, crosslinking agents, photosensizer and solvents which are designed to achieve advanced patterning are added to pigment dispersions with superior color characteristics. It is then filtered and filled in bottles in a clean environment.



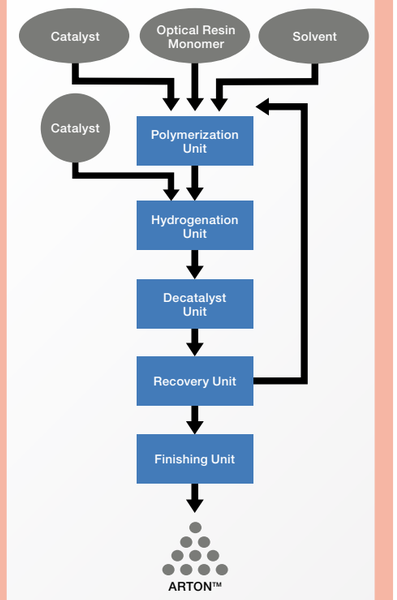
Photoresist for semiconductor manufacturing (Semiconductor Materials)

Polymer and photo acid generators (PAG) designed for cutting edge lithography processes are added to solvents and additives. Then it is filtered and filled in bottles in a clean environment.



ARTON™ (Edge Computing Related Items)

Optical resin monomers undergo solution polymerization using an organic metal compound as a catalyst. Hydrogen is then added and the catalyst and solvent is removed. Finally it is pelletized in a cleanroom and packed.



YOKKAICHI PLANT

The Yokkaichi Plant was a Japan's first full-scale styrene-butadiene rubber (SBR) production center. It was constructed in 1960 as part of the Yokkaichi Petrochemical Complex. It was designed with the most advanced technologies available at the time from Esso, Houdry, and Goodyear of the United States. In addition to SBR, the plant began manufacturing nitrile rubber (NBR) in 1964 and polybutadiene rubber (BR) in 1965.
It also entered the latex and synthetic resin sectors by using polymerization know-how gained through synthetic rubber manufacturing, beginning production of paper coating latex (PCL) in 1963 and ABS resin in 1964. (JSR's Synthetic Resins business is currently handled by Techno-UMG Co.,Ltd., a JSR Group company.)
The plant later began producing a series of Electronic Materials, making use of unique polymer technologies we acquired in these petrochemicals-related fields. The plant began manufacturing photoresist materials used in semiconductors in 1979, and display materials in 1988.
Ever since, the Yokkaichi Plant has served as the core facility and production base for JSR's Elastomers Business and Digital Solutions Business. It continues to enhance its competitiveness through various initiatives. Those initiatives include the addition of a next-generation semiconductor materials plant in 2009 and the expansion of its capacity for producing styrene butadiene rubber (SSBR), a material for high performance tires that has seen growing global demand in recent years. Additionally, the plant is home to R&D centers—namely, the Performance Polymer Research Laboratories, Display Solution Research Laboratories, Fine Electronic Materials Research Laboratories, Advanced Materials Research Laboratories, and Edge Computing Research Laboratories.
The Yokkaichi Plant is the JSR Group's "main plant," handling everything from R&D to production for a broad range of materials sectors.

Yokkaichi Plant Organization Chart (As of 1 Aug. 2019)

- Yokkaichi Plant Org.
  - Administration Dept.
  - Maintenance Planning Dept.
  - Equipment Inspection Dept.
  - Safety Management Dept.
  - Environmental Protection Dept.
  - Production Dept. I
  - Production Dept. II
  - Production Dept. III
- Headquarters Org.
  - Human Resource Dept./Yokkaichi Training Center
  - Procurement Dept. I
  - Procurement Dept. II
  - Office of Business Process Renovation
  - Safety and Health Promotion Dept.
  - Electronic Materials Div.
  - Edge Computing Div.
  - Intellectual Property Dept.
  - Technology Planning Dept.
  - Process Development and Engineering Dept.
  - Plant & Equipment Management Dept.
  - Technical Dept. I
  - Technical Dept. II
  - Technical Dept. III
  - Tire Materials Technology Development Center
- Yokkaichi Research Center
  - Performance Polymer Research Lab.
  - Display Solution Research Lab.
  - Fine Electronic Materials Research Lab.
  - Advanced Materials Research Lab.
  - Edge Computing Research Lab.
  - Material Characterization & Analysis Lab.
  - Fine Chemical Process Dept.
  - Materials Informatics Initiative
  - R&D Administration Dept.

Activities for Environment and Safety

Accreditations regarding plant safety

High Pressure Gas Safety Act:	Safety / completion inspection
Fire Service Act:	Completion inspection
Industrial Safety and Health Act:	Overhaul inspection period of class-1 pressure vessels

International standards

ISO14001, ISO9001

Awards

1982	Safety Award, Japan Chemical Industry Association
1989	Excellent High Pressure Gas Manufacturing Plant Award, Minister of Commerce, trade and industry
1993	Superior Dangerous Relations Office Award, Commissioner of Fire and Disaster Management Agency
2003	Excellent Energy Control Factory Award (Thermal category) from Director-General, Chubu Bureau of Economy, Trade and Industry
2010	Achieved the third class of accident free record (12 million hours)
2012	Safety Award Grand Prize, Japan Chemical Industry Association

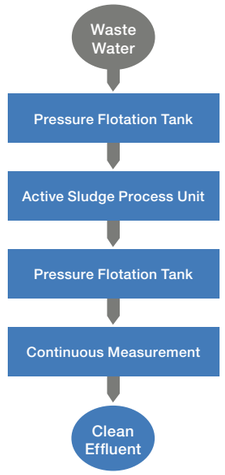
The International Center for Environmental Technology Transfer (ICETT) was established by Mie Prefecture and Yokkaichi City in 1990, to promote the transfer of Japan's environment and safety-related technologies to other countries, and make an international contribution to the resolution of global environmental issues. Similarly, JSR Corporation makes an international contribution by proactively presenting our environmental and safety technologies to trainees from around the world and conducting joint research.

Spherical tanks:
Withstands large-scale earthquakes (600 gals)

Regenerative thermal oxidizer:
Measures against volatile organic compounds and offensive odors

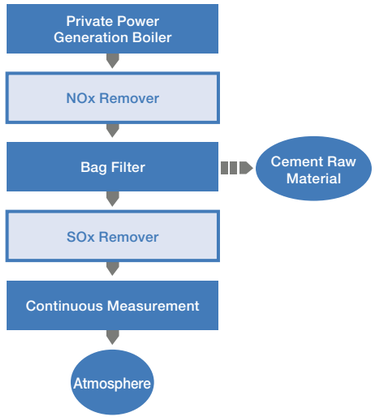
Wastewater treatment flowchart

Wastewater is processed by an oil separator that separates oil and water, and a comprehensive wastewater treatment facility comprised of biotreatment equipment, that breaks down waste using organisms, and activated carbon treatment equipment that treats wastewater with low biodegradability.



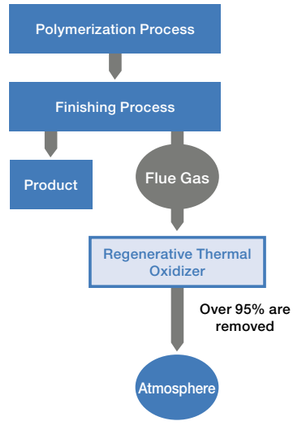
Boiler exhaust treatment flowchart

Electricity is generated onsite by boilers. The heavy oil and coal used as fuel in the plant's boilers contain sulfur and nitrogen. When burned, they produce sulfur oxide (SOx) and nitrogen oxide (NOx). Because these byproducts are a source of photochemical smog and other forms of air pollution, the boilers' exhaust is treated by desulfurization and denitration equipment.

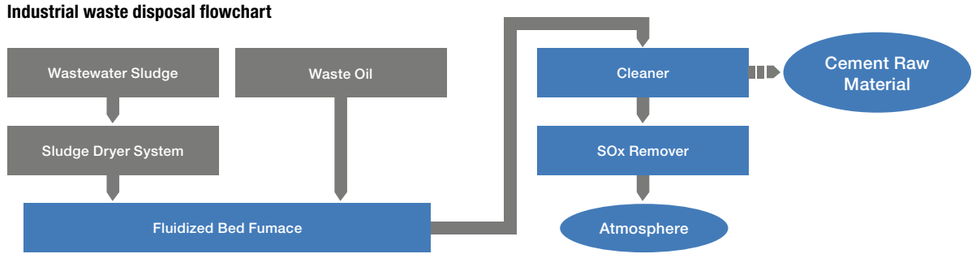


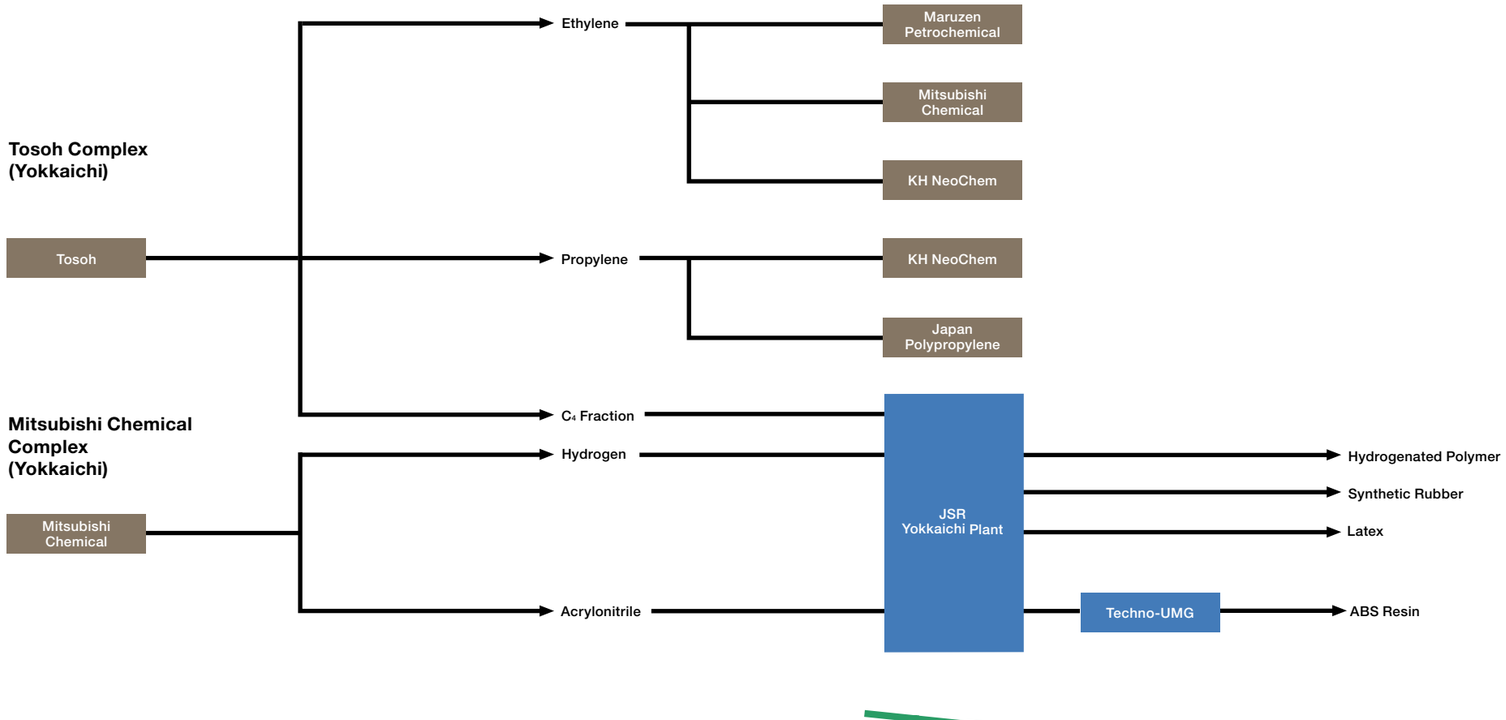
Synthetic rubber manufacturing exhaust treatment flowchart

A regenerative thermal oxidizer (RTO) is a facility that detoxifies exhaust by oxidizing and combusting odorants and hydrocarbon traces in it by passing it through a heat reservoir (ceramic).

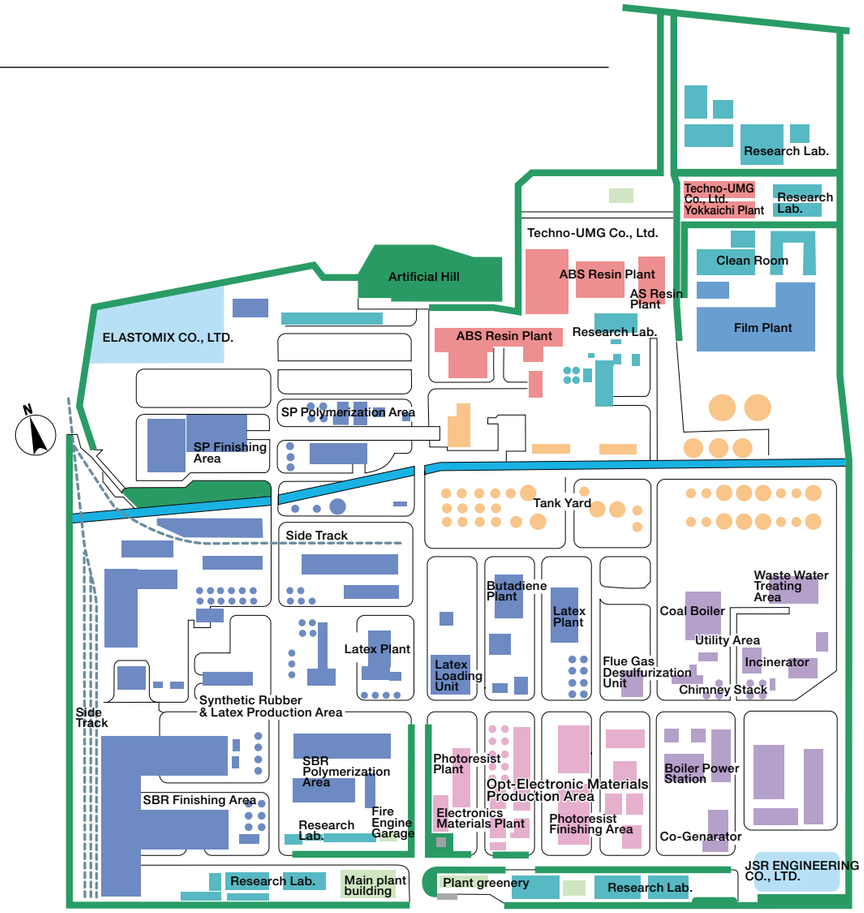


Industrial waste disposal flowchart





Yokkaichi Plant Layout

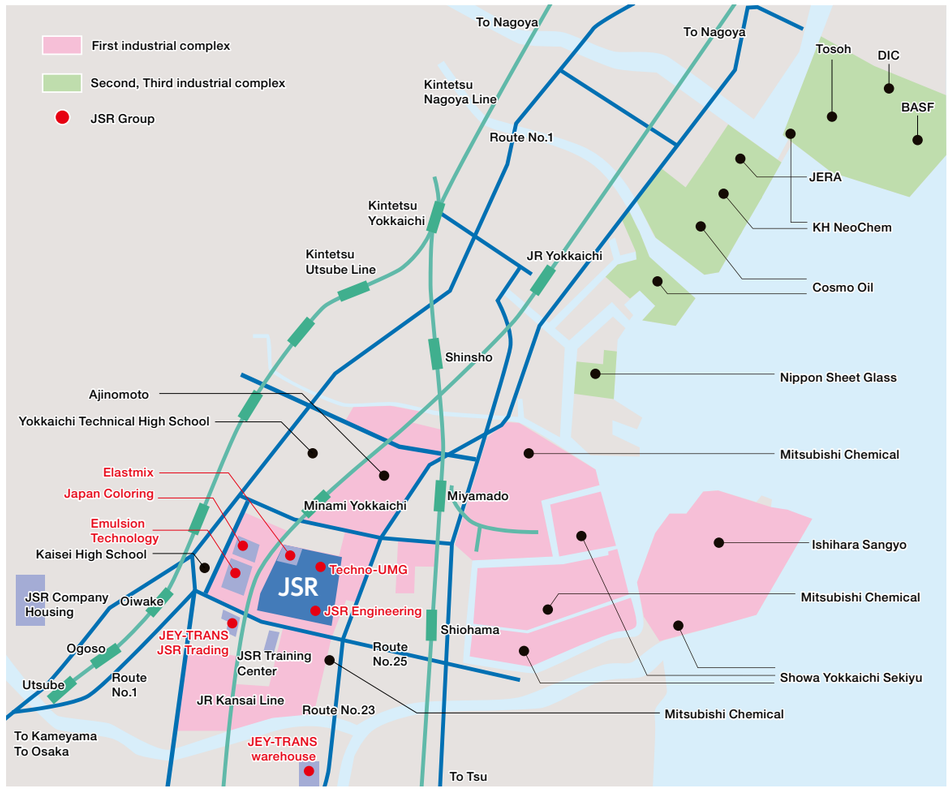


COLUMN

Hands-on safety training and plant museum

The Yokkaichi Training Center provides hands-on safety training primarily to new employees. Trainees gain actual experience in avoiding getting caught in rotating machinery being exposed to liquids, dealing with solvent explosions, and hanging from a safety belt. They also practice basic plant operations, including how to use tools and valve operations. Additionally, a plant museum in the Center displays many cut-away models showing the internal structures of pumps, compressors, valves, and steam traps that are used in employee education.

Yokkaichi Plant and its vicinity



CHIBA PLANT

In 1968, JSR constructed and began operating its second plant, a butadiene plant, at the Chiba Seaside Industrial Zone. The following year, 1969, a polybutadiene rubber (BR) plant was completed. The plant established an integrated production system that covered everything from raw materials to products. In 1973, the world's first thermoplastic elastomers, developed with JSR's own technologies, and a butadiene resin (RB) plant started operation. In September of 1997, a plant for ARTON™ resins, which have superior heat-resistant transparency, came on line. The Chiba Plant acquired certification under the international quality assurance standard ISO 9001 in 1997, and under the international environmental management system standard ISO 14001 in 1999.

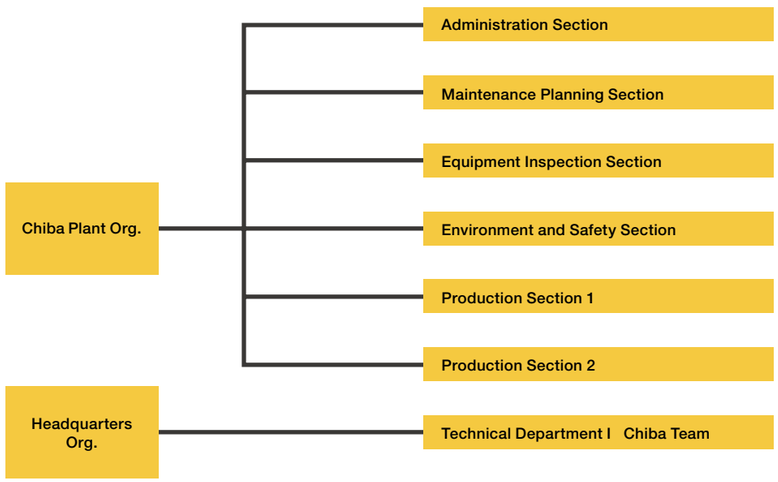
BR

RB

ARTON™ Resin

Butadiene Plant

Chiba Plant Organization Chart (As of 1 Sept. 2019)



Activities for Environment and Safety

Accreditations regarding plant safety

High Pressure Gas Safety Act:	Safety / completion inspection
Fire Service Act:	Completion inspection
Industrial Safety and Health Act:	Overhaul inspection period of class-1 pressure vessels

International standards

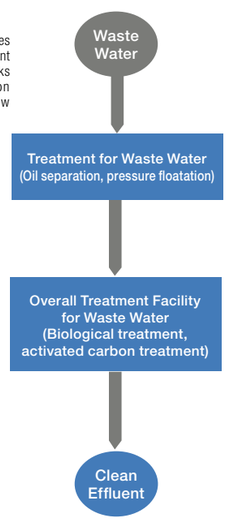
ISO14001, ISO9001

Awards

1986	Excellent High Pressure Gas Manufacturing Plant Award, Minister of Commerce, trade and industry
1994	Superior Dangerous Relations Office Award, Commissioner, Fire and Disaster Management Agency
1995	Excellence Award (Safety), Minister of Labor
1999	Safety Award, Japan Chemical Industry Association
2002	Effort Award (Heath), Minister of Health, Labor, and Welfare
2007	Achieved the second class of accident free record (98million hours)
2010	Safety Award, Japan Chemical Industry Association
2010	Encouragement Award, Director, Chiba Labor Bureau
2013	Responsible Care Award, Japan Chemical Industry Association

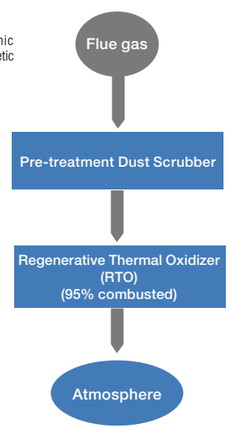
Wastewater treatment flowchart

Wastewater is processed by an oil separator that separates oil and water, and a comprehensive wastewater treatment facility comprised of biotreatment equipment, that breaks down waste using organisms, and activated carbon treatment equipment that treats wastewater with low biodegradability.



VOC emissions treatment flowchart

A heat storage combustion facility treats volatile organic compounds (VOC) existing in exhaust emitted from the synthetic rubber drying process.



Reducing the plant's environmental footprint

The Chiba Plant conducts environmental impact studies for chemical substances and strives to systematically reduce its environmental emissions. It reduces its environmental footprint in terms of waste through diligent observation and practice of "reduction", "reuse", and "recy-cling".

Water pollution prevention

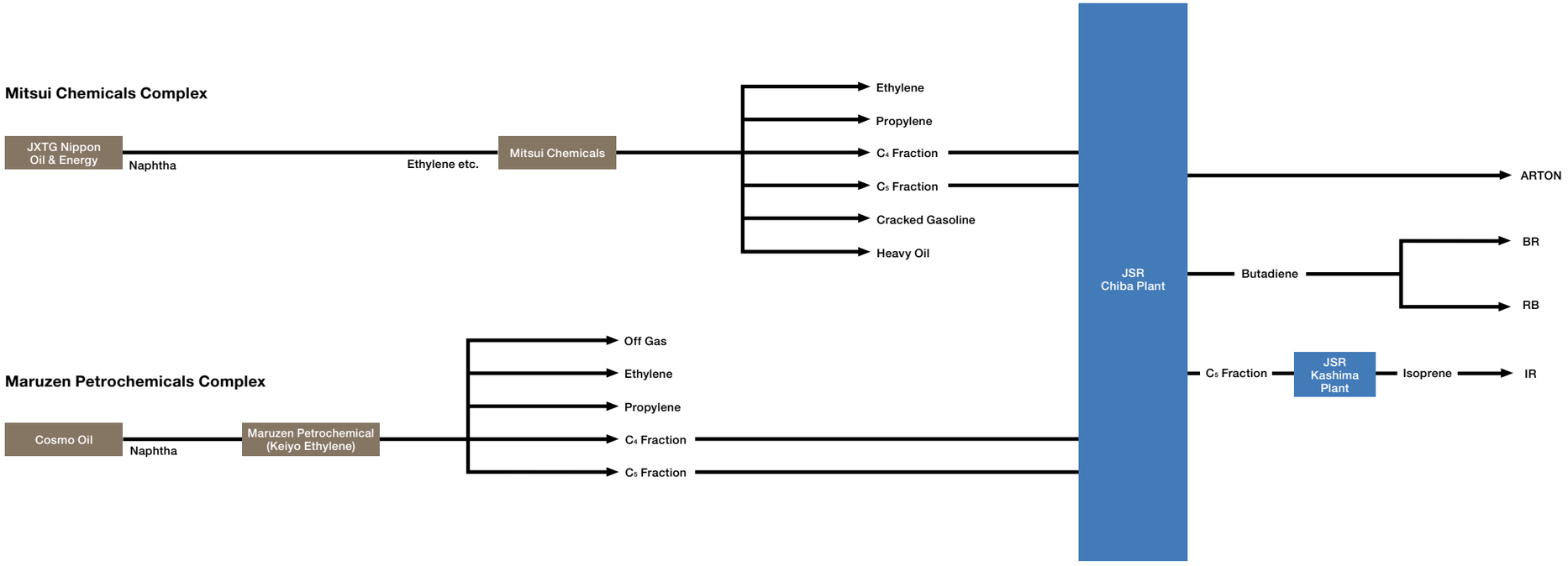
The plant strives to keep pollution below the requirements of the Water Pollution Control Law and pollution control agreements by treating plant wastewater with oil and water separation, flotation, activated sludge, and activated carbon treatment technologies.

Air pollution control act

The plant installed heat-storage, combustion-type deodorizing equipment for the synthetic rubber finishing process that treats volatile organic compounds (VOC) with high efficiency.

Biological wastewater treatment facility

Regenerative Thermal Oxidizer



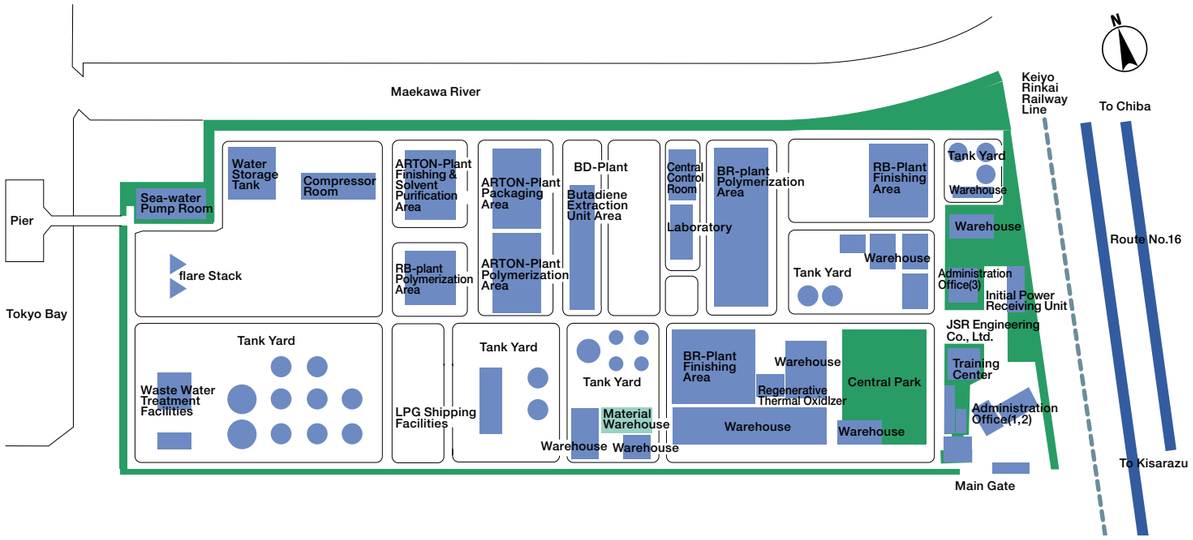
COLUMN

Safety and environmental education activities

The Chiba Plant also provides safety and environmental education from a variety of angles. The Training Center provides hands-on training on pinching, static electricity, and other dangers; education on safety and environmental laws; and televised training that links JSR's three plants. For new employees and young operators, it provides simulated operations training for practice in dealing with various actual worksite problems as well as on-the-job training for practical skills improvement. It also organizes regular lifesaving courses by the Ichihara Fire Department.




Chiba Plant Layout

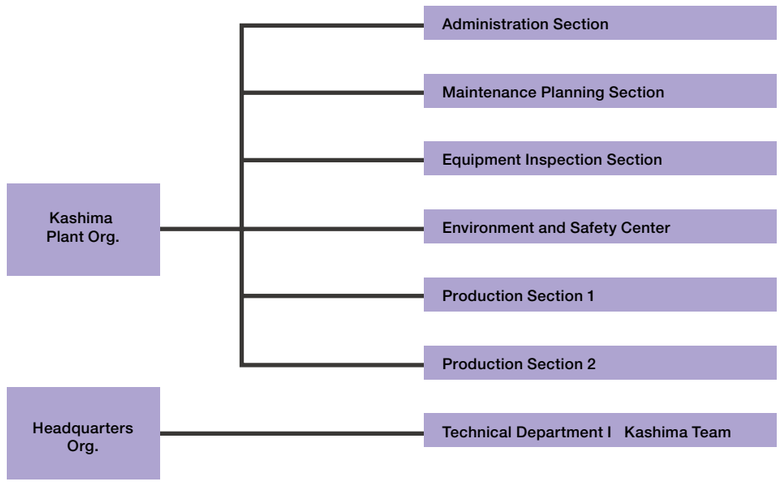


Chiba Plant and its vicinity

KASHIMA PLANT

The Kashima Plant was constructed as JSR's third plant with experience gained through the Yokkaichi and Chiba Plants in synthetic rubber manufacturing. Design emphasis was placed on product sophistication and high production efficiency as well as streamlining, energy savings and safety. Facilities for manufacturing butadiene and styrene-butadiene rubber (SBR) were completed and began operation in 1971. The following year, 1972, facilities for manufacturing isoprene and isoprene rubber (IR) were completed and began domestic production of these products for the first time in Japan. These facilities were installed in anticipation of expanding demand for IR, which has qualities resembling natural rubber. In 1989, latex manufacturing facilities were constructed and began operation at the Kashima Plant, making it the second JSR plant to have this capability, following the Yokkaichi Plant. In 1992, the Kashima Plant also began producing ethylene propylene rubber (EP). As its facilities were expanded and improved, the plant acquired certification under the international quality management system ISO 9002 in 1997 (switched to ISO 9001 in 2002 and to the 2008 version in 2009) and under the international environmental management system ISO 14001 in 1999 (switched to the 2015 version in 2017). Meanwhile, the plant ceased SBR production in 1982 in response to a change in the synthetic rubber demand structure. The unneeded SBR production facilities were then used in the new construction of Japan Butyl Co., Ltd.'s Kashima Plant, which began manufacturing halogenated butyl rubber in 1985. In 1987, the Kashima Plant of Shell JSR Elastomers K.K., which was established through a merger between JSR and Shell in Japan (currently Kraton JSR Elastomers K.K. following a merger with Kraton Polymers Holdings B.V.), was constructed and began producing thermoplastic elastomers as well as IR on a contracted basis. In 1987, the Kashima Plant received a subsidy from the Ministry of International Trade and Industry as a part of research on alternative energies to petroleum. It then built a pilot plant for the production of coal slurry dispersants, among other products, and proceeded with R&D in this area. The plant's latex production facilities were shut down in 2005, concentrating production in the Yokkaichi Plant to improve competitiveness.

Kashima Plant Organization Chart (As of 1 Sept. 2019)



Activities for Environment and Safety

Accreditations regarding plant safety

High Pressure Gas Safety Act:	Safety / completion inspection
Fire Service Act:	Completion inspection
Industrial Safety and Health Act:	Overhaul inspection period of class-1 pressure vessels

International standards

ISO14001, ISO9001

Awards

1976	Progress Award (Safety), Labor Standards Bureau
1979	Safety Award, Japan Chemical Industry Association
1992	Excellent High Pressure Gas Manufacturing Plant Award, Minister of Commerce, trade and industry
1993	Progress Award (Safety), Minister of Labor
1994	Self-defense Fire Brigade Award, Commissioner, Fire and Disaster Management Agency
1995	Excellence Award (Safety), Minister of Labor

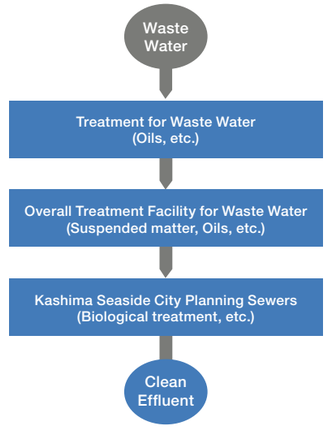
The Kashima Plant organized a "general affairs and environmental countermeasures liaison council," which is comprised of all companies in the Tobu Industrial Complex, and participates in the "Kashima Tobu Industrial Complex security measures liaison council" that tackles safety and security issues. The plant promotes the activities of both organizations.


Disaster drill


Ground flare (environmental facility)

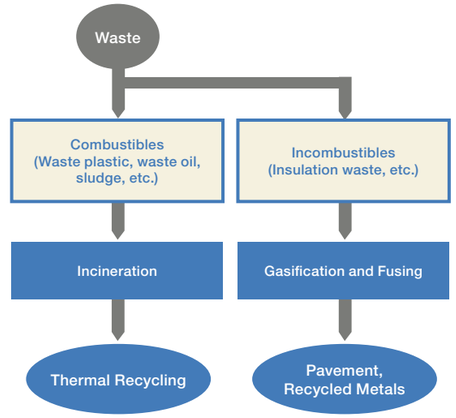
Wastewater treatment flowchart

Before discharging processed wastewater, it is handled by a comprehensive wastewater treatment plant and then by Ibaraki prefecture Kashima rinkai urban sewage.



Industrial waste disposal flowchart

We are promoting recycling to achieve zero industrial waste (zero emission).

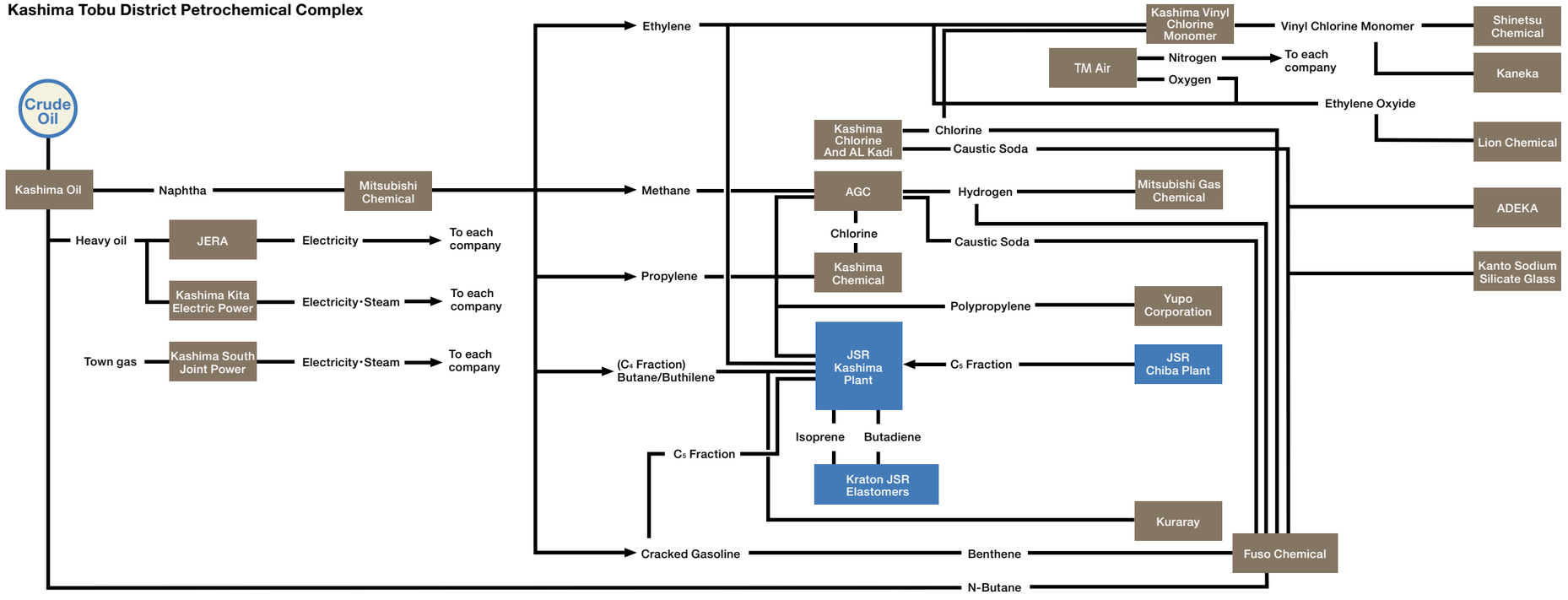


●Major disaster security facilities

The Kashima plant maintains various facilities to prevent and prepare for disasters. (Below are examples)

Facility	Purpose
Fire engine	Early/escalation prevention (Drain water capacity 6,000ℓ/min, Upward 60meters)
Transport vehicle for the injured	Emergency transport for savings life in case of man-made disaster
Public relation vehicle	Communication with the local community
Seismometer	In case of a large earthquake, plant and pipelines will be stopped automatically and PA system will be announced throughout the plant
Anemometer	Safety measures for high place work, if the wind blows over certain strength suspension will be announced automatically
Road shutoff device interlocked with gas detection	Shut off the road in case of gas leakage
Plant disaster monitoring system	Plant monitoring in normal situation, Site monitoring and used for prevention command in case of disaster

Kashima Tobu District Petrochemical Complex

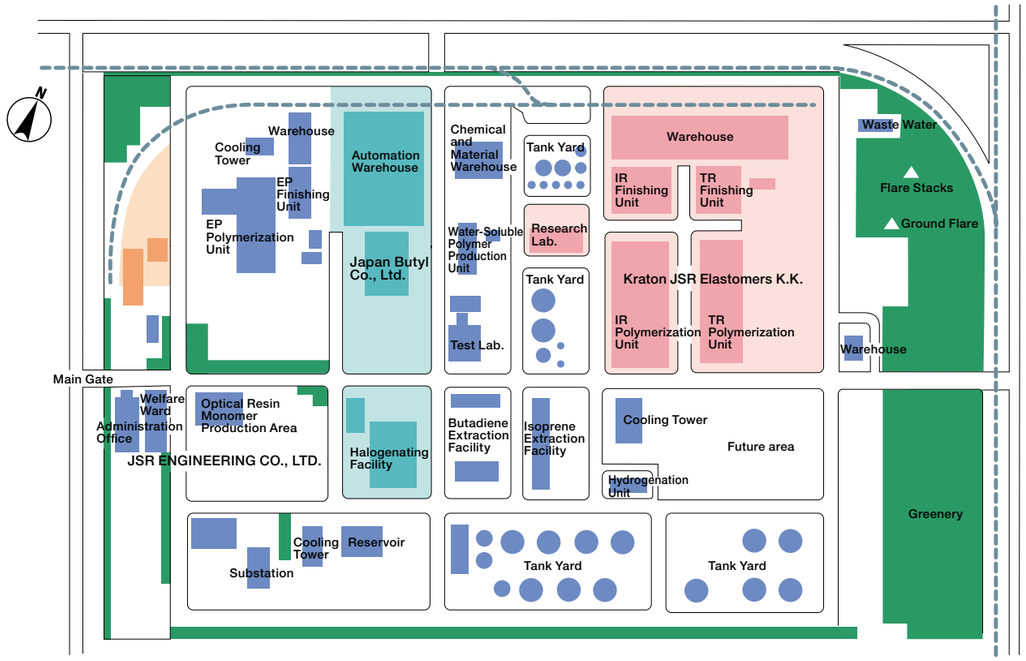


COLUMN

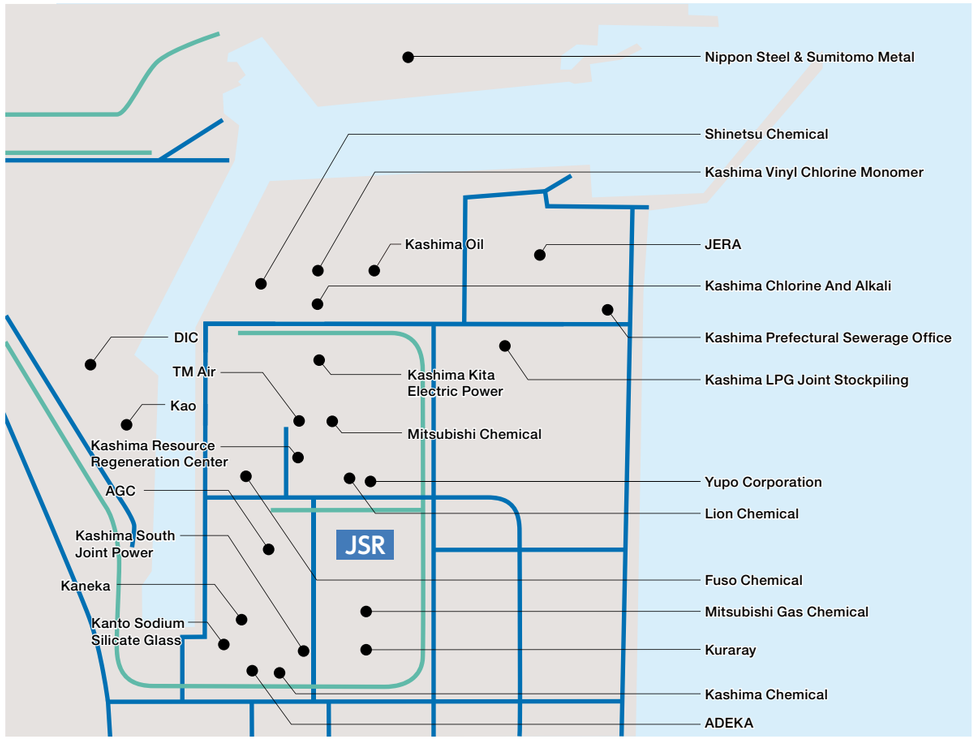
Upgrade work on isoprene towers

The Kashima Plant produces isoprene monomers (IPM), which are monomers of tire rubber (mainly IR) made with the C5 fraction from ethylene centers.
There are a total of 19 towers used for IPM extractive distillation and refinement. Three large towers (length: approx. 53 m; diameter: 2.0 to 3.2 m : weight 120 to 200 tons) underwent a full-scale upgrade during the FY2014 regular maintenance period (May to July) to replace antiquated equipment and improve energy efficiency.
The new tower, which was manufactured at other prefecture, was unloaded at Kashima Port and transported by land. Existing towers were removed and installation of the new tower was completed. Mobilizing a total of 6,080 workers and requiring a work schedule of approximately 160 days, it was described as the largest project after the Kashima Plant started operation in 1971. We experienced zero accidents, zero disasters, zero pollution (three zeros).

Kashima Plant Layout



Kashima Plant and its vicinity



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