PRTR Estimation Manual

27. Bonded Adhesive Products Manufacturing Industry

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Prepared by the Working Group for
the Grind Wheels Manufacturing Industry

Contents

Chapter 1 Outline of the PRTR System

The English description here is omitted.

Chapter 2 Release and Transfer Calculation Methods

The English description here is omitted.

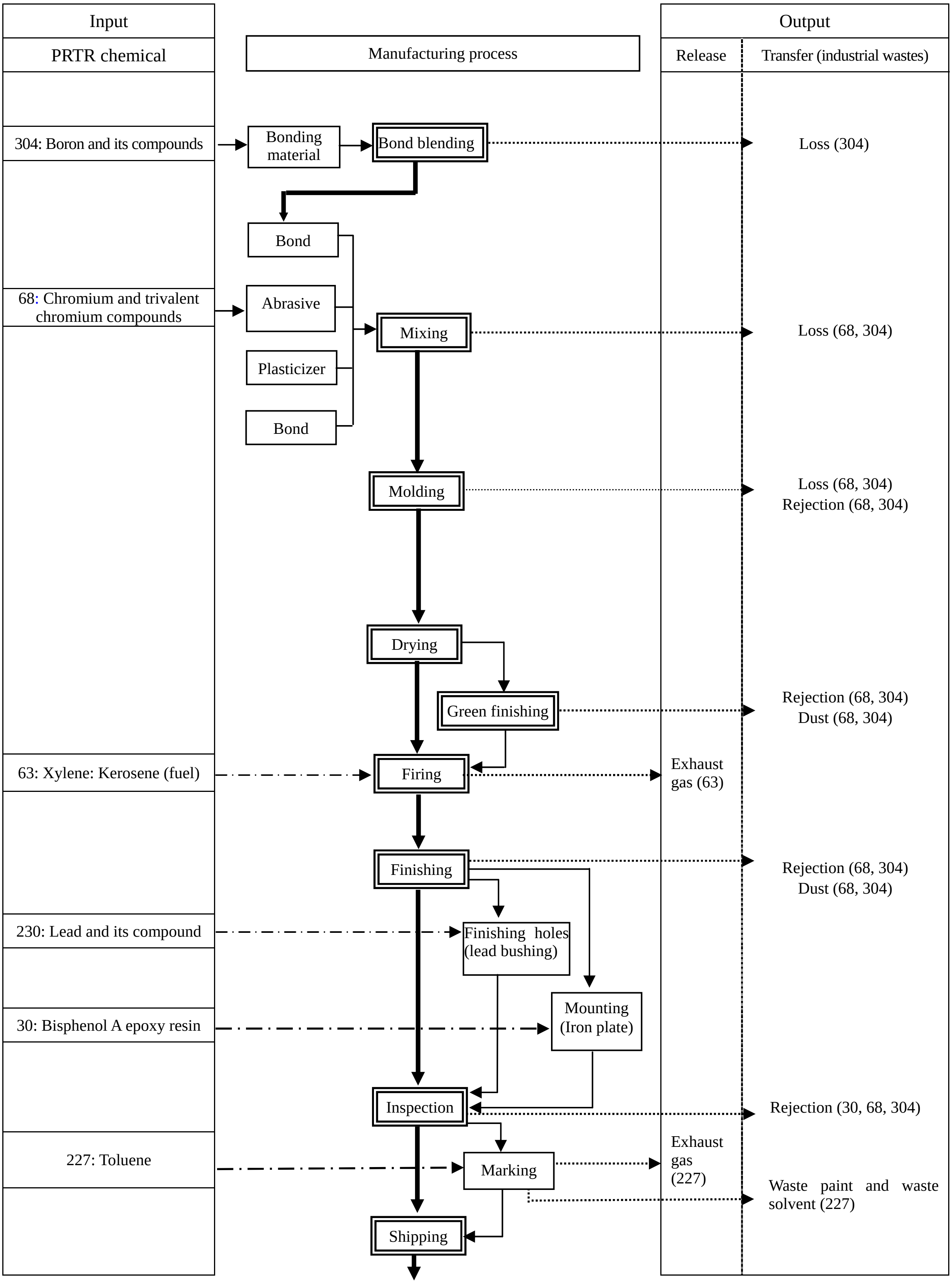
Chapter 3 Methods and Examples of Calculation of Releases and Transfers in Typical Processes

The processes of bonded abrasive products manufacturing are bond blending, mixing, molding, drying, firing (baking), finishing, and inspection. The figure below shows releases and transfers calculation methods by process for the PRTR chemicals that are very commonly used by companies.
This is a typical model and may not represent every release and transfer. Each company should adapt the model according to their situation.

1. Vitrified bonded abrasive products

【Sample process flow diagram】

Process flow diagram for the manufacturing of vitrified bonded abrasive products and main release points



Notes:
・The numbers in parentheses show PRTR chemical numbers .
・All those chemicals are not necessarily used in each process.

[Model for calculating releases and transfers in manufacturing vitrified bonded abrasive products]

Total annual consumption of raw materials: 1,000 t/year

(Breakdown)	t/year	(%)
• Abrasives containing chromium (chromium content: 1.4%)	250	25
• Other abrasives	580	58
• Bond (boron content: 3%)	120	12
• Plasticizer	30	3
• Binder	20	2

(Loss ratio by process)

Bond blending: 0.1%: Mixing: 0.2% (including collected dust): Molding 0.2%

(Rejection ratio by process)

Molding: 0.1%; Green finishing: 0.1%; Finishing: 1.0%; Inspection: 0.5%

(Dust)

Green finishing: 1.0%; Finishing: 10% (including collected dust)

The above model shows an example of the manufacturing of a vitrified bonded abrasive product. For actual calculation, the annual amount handled for each company is used.

When PRTR chemicals are released to water bodies (transferred to sewerage), the amount of releases (transfers) shall be considered.

(1) Bond blending process

This is a process for blending materials of the bond.

PRTR chemicals are transferred through the discard of raw materials as wastes that are generated in the blending process, adhering to equipment, or collected by a dust collector. The discard in this process is called “bond blending loss”. Transfers by other forms are not significant and require no notification.

【Example of PRTR chemicals】

(Bonding materials) Boron and its compounds

【Calculation procedure】

Transfers in the bond blending process are basically calculated as follows:

A) Calculation of the annual amount of PRTR chemical contained in the bonding material ⇐ { Annual consumption of bonding material × Content of PRTR chemical in the bonding material }

↓

B) Calculation of the annual amount of PRTR chemical in the bond blending loss (transfers) ⇐ { Annual amount contained in the bonding material × Bond blending loss rate }

↓

C) Calculation of the annual amount of PRTR chemical transferred to the next process	⇦	A) - B)

【Example of calculation】

① Boron

A) Calculating the amount of boron contained in the bonding material

(Amount of boron contained in the bonding material)

= (annual consumption of bonding material) × (content of boron in the bonding material)

= 120 t/year × 3% ÷ 100 × 1000

= 120 t/year × 1000 × 3% ÷ 100

= 120,000 kg/year × 0.03

= 3,600 kg/year

B) Calculating the amount of boron contained in the bond blending loss (transfers)

(Amount of boron contained in the bond blending loss)

= A) × (bond blending loss ratio)

= 3,600 kg/year × 0.1% ÷ 100

= 3,600 kg/year × 0.001

= 3.6 kg/year

C) Calculating the amount of boron transferred to the next process

(Amount of boron transferred to the next process)

= A) - B)

= 3,600 kg/year - 4 kg/year

= 3,596 kg/year

(2) Mixing process

This is a process for mixing abrasives, bond, plasticizer, and binder by using a mixer.

PRTR chemicals are transferred through the discard of molding materials as waste that are generated in the bond blending process, adhering to equipment, or collected by a dust collector. The discard in this process is called a “mixing loss”. Transfers in other forms are not significant and require no notification.

【Example of PRTR chemicals】

(Bond)	Boron and its compounds
(Abrasive)	Chromium and trivalent chromium compounds

【Calculation procedure】

Transfers in the mixing process are basically calculated as follows:

A) Calculation of the annual amount of PRTR chemical contained in the raw material ⇐ Annual consumption of raw material × Content of PRTR chemical in the raw material

↓

B) Calculation of the annual amount of PRTR chemical in the mixing loss (Transfers) ⇐ Annual mixing loss × Content of PRTR chemical in the mixing loss

↓

C) Calculation of the annual amount of PRTR chemical transferred to the next process ⇐ A) - B)

【Example of calculation】

① Boron

A) Calculating the amount of boron contained in the bond

(Amount of boron released from the mixing process)

= C) in bond blending process (1)

= 3,596 kg/year

B) Amount of boron contained in the mixing loss (transfers)

(Amount of boron contained in the mixing loss)

= A) × (mixing loss ratio)

= 3,596 kg/year × 0.2% ÷ 100

= 3,596 kg/year × 0.002

= 7.2 kg/year

C) Calculating the amount of boron transferred to the next process

(Amount of boron transferred to the next process)

= A) - B)

= 3,596 kg/year - 7 kg/year = 3,589 kg/year

② Chromium

A) Calculating the amount of chromium contained in the abrasive

(Amount of chromium contained in abrasives)

= (annual consumption of abrasive containing chromium) × (chromium content)

= 250 t/year × 1.4% ÷ 100 × 1000

= 250 t/year × 1,000 × 1.4% ÷ 100

= 250,000 kg/year × 0.014

= 3,500 kg/year

B) Calculating the amount of chromium contained in the mixing loss (transfers)

(Amount of chromium contained in the mixing loss)

= A) × (mixing loss ratio)

= 3,500 kg/year × 0.2% ÷ 100

= 3,500 kg/year × 0.002

= 7.0 kg/year

C) Calculating the amount of chromium transferred to the next process

(Amount of chromium transferred to the next process)

= A) - B)

= 3,500 kg/year - 7 kg/year = 3,493 kg/year

(3) Molding process

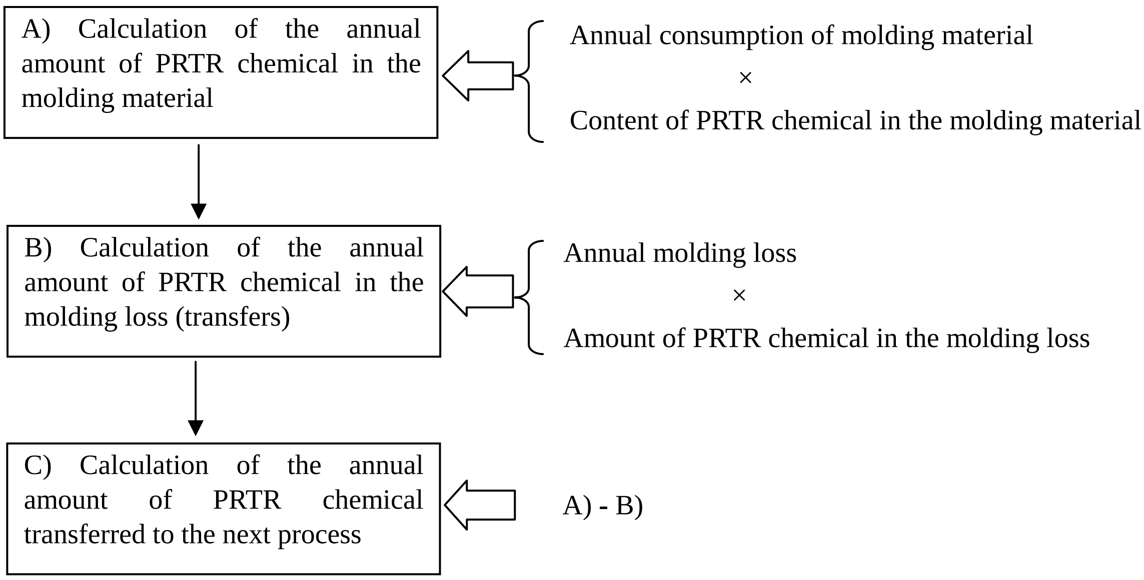
This is a process for molding the mixed materials into a desired shape by using a press or other device.
PRTR chemicals are transferred through the discard of molding materials as rejection of molded products, spill or dust generated during supply of mixed materials, adhering to the equipment for discarding surplus materials or collected by a dust collector. The rejection and waste molding materials in this process are called a “molding loss”. Transfers in other forms are not significant and require no notification.

【Example of PRTR chemicals】

(Molding material) Boron and its compounds Chromium and trivalent chromium compounds

【Calculation procedure】

Transfers in the molding process are basically calculated as follows:



【Example of calculation】

① Boron

A) Calculating the amount of boron contained in the molding material.

(Amount of boron transferred from the mixing process)

= C) in mixing process (2)

= 3,589 kg/year

B) Calculating the amount of boron contained in the molding loss (transfers)

(Amount of boron contained in the molding loss)

= A) × ([molding loss ratio] + [molding rejection ratio])

= 3,589 kg/year × (0.2% + 0.1%) ÷ 100

= 3,589 kg/year × 0.003

= 10.8 kg/year

C) Calculating the amount of boron transferred to the next process

(Amount of boron transferred to the next process)

= A) - B)

= 3,589 kg/year - 11 kg/year = 3,578 kg/year

② Chromium

A) Calculating the amount of chromium and trivalent chromium compounds contained in the molding material

(Amount of chromium transferred from the mixing process)

= C) in mixing process (2)

= 3,493 kg/year

B) Calculating the amount of chromium contained in the molding loss (transfers)

(Amount of chromium contained in the molding loss)

= A) × ([molding loss ratio] + [molding rejection ratio])

= 3,493 kg/year × (0.2% + 0.1%) ÷ 100

= 3,493 kg/year × 0.003

= 10.5 kg/year

C) Calculating the amount of chromium transferred to the next process

(Amount of chromium transferred to the next process)

= A) - B)

= 3,493 kg/year - 11 kg/year = 3,482 kg/year

(4) Drying process

This is a process for strengthening the molded green bonded abrasive products for easy handling and green finishing.

PRTR chemicals are not released or transferred to the environment.

(4-2) Green finishing process

This is a process for tentatively finishing the dried green bonded abrasive products into shapes and dimensions close to those prescribed.

PRTR chemicals are transferred through the discard of dust generated in the green finishing and rejection.

【Example of PRTR chemicals】

(Dust) Chromium and trivalent chromium compounds, boron and its compounds

(Rejection) Chromium and trivalent chromium compounds, boron and its compounds

【Calculation procedure】

Transfers in the green finishing process are basically calculated as follows:

A) Calculation of the annual amount of PRTR chemical in the green bonded abrasive product ⇐ Annual production of green bonded abrasive product × Content of PRTR chemical in the bonded abrasive product

↓

B) Calculation of the annual amount of PRTR chemical contained in the green finishing loss (transfers) ⇐ Annual finishing loss × Amount of PRTR chemical in the green bonded abrasive product

↓

C) Calculation of the annual amount of PRTR chemical transferred to the next process ⇐ A) - B)

【Example of calculation】

① Boron

A) Calculating the amount of boron contained in the green bonded abrasive product

(Amount of boron transferred from the molding process)

= C) in molding process (3)

= 3,578 kg/year

B) Calculating the amount of boron contained in the green finishing loss (transfers)

(Amount of boron contained in the green finishing loss)

= A) × ([green finishing dust generation rate] + [green finishing rejection ratio])

= 3,578 kg/year × (1% + 0.1%) ÷ 100

= 3,578 kg/year × 0.011

= 39.4 kg/year

C) Calculating the amount of boron transferred to the next process

(Amount of boron transferred to the next loss)

= A) - B)

= 3,578 kg/year - 39 kg/year = 3,539 kg/year

② Chromium

A) Calculating the amount of chromium and trivalent chromium compounds contained in the green bonded abrasive product

B) (Amount of chromium transferred from the molding process)

= C) in molding process (3)

= 3,482 kg/year

B) Calculating the amount of chromium contained in the green finishing loss (transfers)

(Amount of chromium contained in the molding loss)

= A) × ([green finishing dust generation rate] + [green finishing rejection ratio])

= 3,482 kg/year × (1% + 0.1%) ÷ 100

= 3,482 kg/year × 0.011

= 38.3 kg/year

C) Calculating the amount of chromium transferred to the next process

(Amount of chromium transferred to the next process)

= A) - B)

= 3,482 kg/year - 38 kg/year = 3,444 kg/year

(5) Firing process

This is a process for firing the dried or green finished bonded abrasive product at a prescribed temperature.

Possible releases to the environment include release of PRTR chemicals contained in the bonded abrasive products to the air. However, it is assumed that said PRTR chemicals will not actually be released because they are completely burnt by an afterburner, etc.

If the annual amount of xylene handled that is contained in kerosene exceeds one ton, the amount of release shall be calculated with an emission factor at refueling of 0.0000009 kg/kl[*1].

[*1] "PRTR System and Gas Stations" by the Petroleum Association of Japan and National Federation of Petroleum Cooperative Associations

(6) Finishing process

This is a process for finishing the fired bonded abrasive products into prescribed shapes and dimensions.

PRTR chemicals are transferred through the disposal of dust and rejection in the finishing process.

【Example of PRTR chemicals】

(Dust) Chromium and trivalent chromium compounds, boron, and its compounds

(Rejection) Chromium and trivalent chromium compounds, boron, and its compounds

【Calculation procedure】

Transfers in the finishing process are basically calculated as follows:

A) Calculation of the annual amount of PRTR chemical in bonded abrasive product ⇐ Annual production of bonded abrasive product × Content of PRTR chemical in the bonded abrasive product

↓

B) Calculation of the annual amount of PRTR chemical in finishing loss (transfers) ⇐ Annual finishing loss × Amount of PRTR chemical in the bonded abrasive product

↓

C) Calculation of the annual amount of PRTR chemical transferred to the next process ⇐ A) - B)

【Example of calculation】

① Boron

A) Calculating the amount of boron contained in the bonded abrasive products

(Amount of boron transferred from the green finishing process)

= C) in green finishing process (4-2)

= 3,539 kg/year

B) Calculating the amount of boron contained in finishing loss (transfers)

(Amount of boron contained in finishing loss)

= A) × ([finishing dust generation rate] + [finishing rejection ratio])

= 3,539 kg/year × (10% + 1%) ÷ 100

= 3,539 kg/year × 0.11

= 389.3 kg/year

C) Calculating the amount of boron transferred to the next process

(Amount of boron transferred to the next loss)

= A) - B)

= 3,539 kg/year - 389 kg/year = 3,150 kg/year

② Chromium

A) Calculating the amount of chromium and trivalent chromium compound contained in the bonded abrasive product

(Amount of chromium transferred from the green finishing process)

= C) in green finishing process (4-2)

= 3,444 kg/year

B) Calculating the amount of chromium contained in finishing loss (transfers)

(Amount of chromium contained in finishing loss)

= A) × ([finishing dust generation rate] + [finishing rejection ratio])

= 3,444 kg/year × (10% + 1%) ÷ 100

= 3,444 kg/year × 0.11

= 378.8 kg/year

C) Calculating the amount of chromium transferred to the next process

(Amount of chromium transferred to the next process)

= A) - B)

= 3,444 kg/year - 379 kg/year = 3,065 kg/year

(6-2) Finishing holes process

This is a process for coating the holes of finished bonded abrasive products with metallic lead.

Possible releases to the environment include metallic lead used for marking that is released to the air. However, because the melting temperature is controlled at 450°C or less, it is assumed that there will be no lead fume, and thus release to the air can be ignored.

(6-3) Mounting process

This is a process for mounting the bonded abrasive product on the prescribed iron plates, etc.

Possible releases to the environment include relative chemicals that are evaporated from the mounting agent to the air or transferred through disposal of the mounting agent. However, because the amount handled is small, release to the air and transfer through disposal require no notification.

(7) Inspection process

This is a process for checking the finished bonded abrasive products to determine whether or not they have the prescribed dimensions, shapes, bonding, and balances.

Possible releases to the environment include rejection that is discarded in the inspection process.

Metallic lead contained in rejection does not require notification because it is collected by the company or sold to a recycling agent. Mounted products do not require notification because their rejection ratio is very small.

【Example of PRTR chemicals】

(Rejection) Chromium and trivalent chromium compounds, boron, and its compounds

【Calculation procedure】

Transfers in the inspection process are basically calculated as follows:

A) Calculation of the annual amount of PRTR chemical in the bonded abrasive product ⇐ { Annual production of bonded abrasive product × Content of PRTR chemical in the bonded abrasive product }

↓

B) Calculation of the annual amount of PRTR chemical contained in inspection loss (transfers) ⇐ Annual inspection loss × Content of PRTR chemical in the bonded abrasive product

↓

C) Calculation of the annual amount of PRTR chemicals transferred to the next process ⇐ A) - B)

【Example of calculation】

① Boron

A) Calculating the amount of boron contained in the bonded abrasive product

(Amount of boron transferred from the finishing process)

= C) in the finishing process (6)

= 3,150 kg/year

B) Calculating the amount of boron contained in inspection loss (transfers)

(Amount of boron contained in inspection loss)

= A) × (rejection ratio by inspection)

= 3,150 kg/year × 0.5% ÷ 100

= 3,150 kg/year × 0.005

= 15.7 kg/year

C) Calculating the amount of boron transferred to the next process

(Amount of boron transferred to the next loss)

= A) - B)

= 3,150 kg/year - 16 kg/year = 3,134 kg/year

② Chromium

A) Calculating the amount of chromium and trivalent chromium compounds contained in the bonded abrasive product

(Amount of chromium transferred from the finishing process)

= C) in the finishing process (6)

= 3,066 kg/year

B) Calculating the amount of chromium contained in the inspection loss (transfers)

(Amount of chromium contained in the inspection loss)

= A) × (inspection rejection ratio)

= 3,066 kg/year × 0.5% ÷ 100

= 3,066 kg/year × 0.005

= 15.3 kg/year

C) Calculating the amount of chromium transferred to the next process

(Amount of chromium transferred to the next process)

= A) - B)

= 3,066 kg/year - 15 kg/year = 3,051 kg/year

(7-2) Marking process

This is a process for indicating the type, ill-balanced position, and high speed on the finished bonded abrasive products by spraying paint.

Possible forms of releases to the environment include PRTR chemicals that are released from the solvent components of the paint to the air. However, because the use amount is small, releases to the air and transfers through disposal require no notification.

The total transfers as wastes from all processes are:

(Transfers of boron) = (bond blending loss) + (mixing loss) + (molding loss) + (green finishing loss)

+ (finishing loss) + (inspection loss)

= 3.6 kg/year + 7.2 kg/year + 10.8 kg/year + 39.4 kg/year + 389.3 kg/year + 15.8 kg/year

= 466.1 kg/year

(Transfers of chromium) = (mixing loss) + (molding loss) + (green finishing loss)

+ (finishing loss) + (inspection loss)

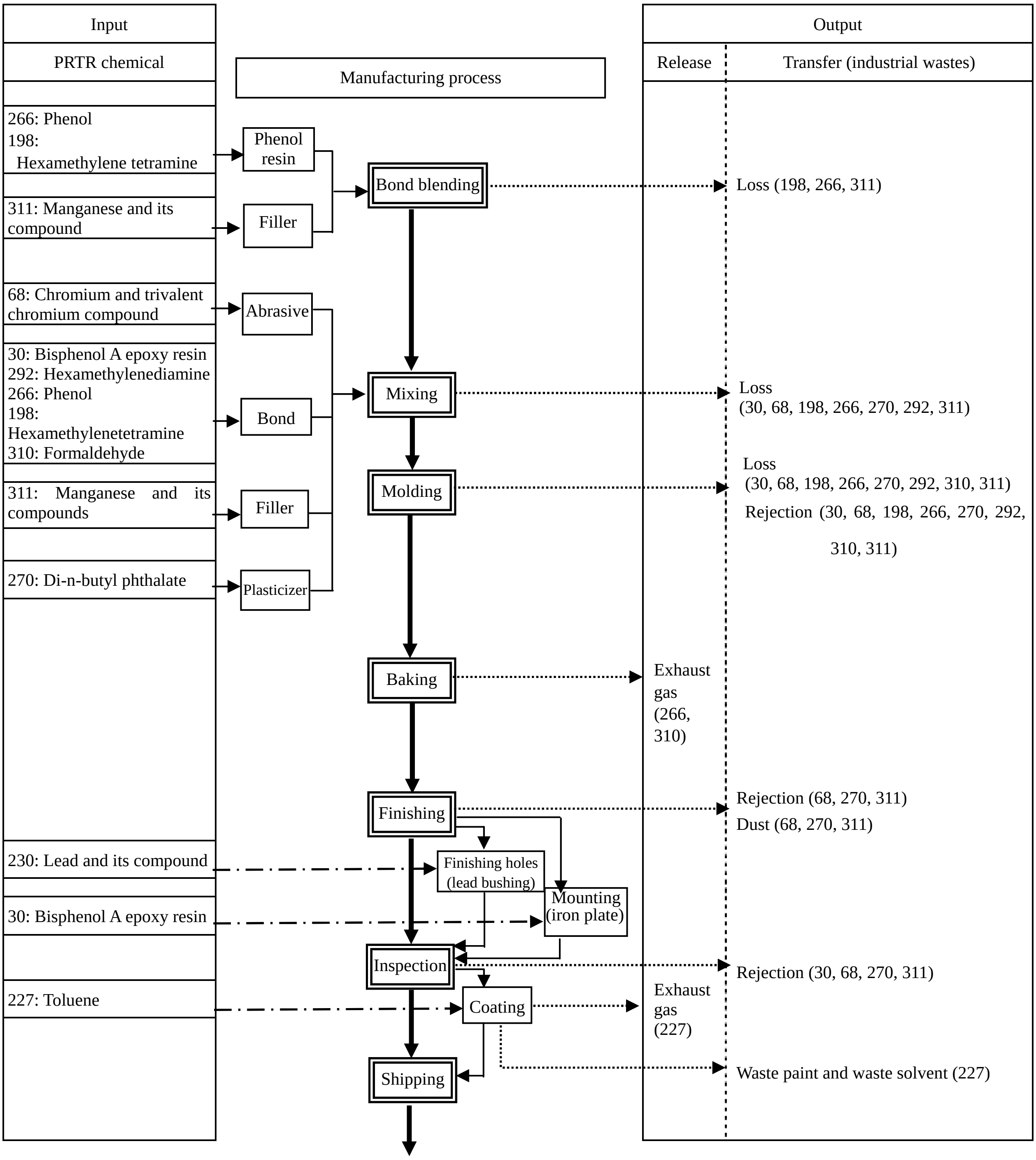
= 7.0 kg/year + 10.5 kg/year + 38.3 kg/year + 378.8 kg/year + 15.3 kg/year

= 449.9 kg/year

2. Resinoid bonded abrasive products

【Process flow diagram example】

Process flow diagram for the manufacturing of resinoid bonded abrasive products and the main release points



Notes:
・The numbers in parentheses show PRTR chemical number.
・All those chemicals are not necessarily used in each process.

[Model of calculation for resinoid bonded abrasive product]

Total annual consumption of raw materials: 1,000 t/year

(Breakdown)		t/year	(%)
• Abrasive containing chromium (chromium content: 1.4 %)		250	25
• Other abrasive		500	50
• Bond	Powder phenol resin	130	13
	Liquid phenol resin	20	2
• Filler containing manganese (manganese content: 10%)		30	3
	Other filler	50	5
• Plasticizer	Di-n-butyl phthalate	10	1
	Other plasticizer	10	1

(Loss ratio by process)
Bond blending: 0.1%　Mixing: 0.2% (including collected dust)　Molding: 0.2%
(Rejection ratio by process)
Molding: 0.1%　Finishing: 0.5%　Inspection: 0.5%
(Dust)
Finishing dust: 3% (including collected dust)

* The component ratios after baking are calculated as explained below on the assumption that they are the same as those at molding if the components that are evaporated at baking are ignored.

The above model applies to resinoid bonded abrasive products. For actual calculation, the annual amount handled by each company is used.

Epoxy resin shall be calculated in the same way as phenol resin. **The discharge of epoxy resin to the air may be ignored.**

【Amount of gas generated at baking of phenol resin】
The emission factors (generation) of phenol, formaldehyde, and hexamethylenetetramine (hexamine) at baking of phenol resin in the bonding material (baking temperature: 200°C) were estimated by referencing data from the Japan Thermosetting Plastics Industry Association (as follows):

A. Resol type (liquid): Alkali resol (condensed type, medium grade of molecular weight)
Emission factor of phenol: 10% of the phenol content
Emission factor of formaldehyde: 100% of the formaldehyde content (all)
B. Novolac type (powder): Standard novolac
Emission factor of phenol: 2.2% of the phenol content
Emission factor of hexamethylenetetramine: 0 (total decomposition with no generation)

(Reference) Data from the Japan Thermosetting Plastics Industry Association
A. Resol type (liquid): Alkali resol (condensed type; medium grade of molecular weight)
Uses: Abrasives, forms, castings, refractories, and molding material

Table 1 Content of PRTR chemicals in the measured specimen

Specimen	Nonvolatile component (%)	Content of PRTR chemical (%)	
		Phenol	Formaldehyde
Resol (liquid)	79	5.4	0.3

Table 2　Generated gas measurement results

Specimen	Hot plate temperature (°C)	Phenol (%/specimen)	Formaldehyde (%/specimen)	Ammonia (%/specimen)
Resol (liquid)	200	0.4 to 0.6	0.2 to 0.4	None

B. Novolac type (powder)

Standard novolac, containing 5% free phenol and also some hexamine

Uses: Abrasive materials, castings, grinding wheels, and molding material

Table 3 Content of PRTR chemicals in the measured specimen

Specimen	Content of PRTR chemical (%)		
	Phenol	Formaldehyde	Hexamine
Novolac (powder)	4.5	0	9.1

Table 4 Generated gas measurement results

Specimen	Hot plate temperature (°C)	Phenol (%/specimen)	Formaldehyde (%/specimen)	Ammonia (%/specimen)
Novolac (powder)	200	0.07 to 0.12	Below 0.01	0.4 to 0.7

(1) Bond blending process

This is a process for blending the bond (powder phenol resin) and filler.

Possible forms of release to the environment include PRTR chemicals contained in the bond and filler that are released to the air. However, it is assumed that the installation of a dust collector will prevent release to the air and that transfer is limited to wastes in bond blending loss.

【Example of PRTR chemicals】

(Bond) Phenol, hexamethylenetetramine (hexamine)

(Filler) Manganese and its compounds

【Calculation procedure】

Transfers in the bond blending process are basically calculated as follows:

A) Calculation of the annual amount of PRTR chemical in bonding material ⇦ Annual consumption of bonding material × Content of PRTR chemical in bonding material

↓

B) Calculation of the annual amount of PRTR chemicals in bond blending loss (transfers) ⇦ Annual amount in bonding material × Bond blending loss rate

↓

C) Calculation of the annual amount of PRTR chemical transferred to the next process ⇦ A) - B)

【Example of calculation】

① Phenol

A) Calculating the amount of phenol contained in the bond

(Amount of phenol contained in the bond)

= (annual consumption of bond) × (content [%] of phenol in the bond)

= 130t/year × 1,000 × 4.5%÷ 100

= 130,000 kg/year × 0.045

= 5,850 kg/year

B) Calculating the amount of phenol contained in mixing loss (transfers)

(Amount of phenol contained in mixing loss)

= A) × (bond blending loss ratio)

= 5,850 kg/year × 0.1% ÷ 100

= 5,850 kg/year × 0.001

= 5.9 kg/year

C) Calculating the amount of phenol transferred to the next process

(Amount of phenol transferred to the next process)

= A) - B)

= 5,850 kg/year - 6 kg/year

= 5,844 kg/year

② Manganese

A) Calculating the amount of manganese contained in filler

(Amount of manganese contained in filler)

= (annual consumption of filler) × (content % of manganese in filler)

= 30t/year ×1,000 × 10% ÷ 100

= 30,000 kg/year × 0.1

= 3,000 kg/year

B) Calculating the amount of manganese contained in bond blending loss (transfers)

(Amount of manganese contained in mixing loss)

= A) × (bond blending loss ratio)

= 3,000 kg/year × 0.1% ÷ 100

= 3,000 kg/year × 0.001

= 3.0 kg/year

C) Calculating the amount of manganese transferred to the next process

(Amount of manganese transferred to the next process)

= A) - B)

= 3,000 kg/year - 3 kg/year

= 2,997 kg/year

(2) Mixing process

This is a process for mixing the abrasives, bond, filler, and plasticizer using a mixer.

Possible transfer of PRTR chemicals includes wastes in the mixing loss. The plasticizer (di-n-butyl phthalate) is transferred as product because it remains in the tissues of bonded abrasive products. Because the amount is small in all other cases, no notification is necessary.

【Example of PRTR chemicals】

(Abrasive)	Chromium and trivalent chromium compounds
(Bond)	Bisphenol-A epoxy resin, hexamethylenediamine, phenol, hexamethylenetetramine (hexamine), and formaldehyde
(Filler)	Manganese and its compounds
(Plasticizer)	Di-n-butyl phthalate

【Calculation procedure】

Transfer in the agitation process is basically calculated as follows:

A) Calculation of the annual amount of PRTR chemical in raw material ⇐ { Annual consumption of raw material × Content of PRTR chemical in raw material }

↓

B) Calculation of the annual amount of PRTR chemical in mixing loss (transfers) ⇐ { Annual mixing loss × Content of PRTR chemical in mixing loss }

↓

C) Calculation of the annual amount of PRTR chemical transferred to the next process ⇐ A) - B)

【Example of calculation】

① Chromium

A) Calculating the amount of chromium contained in the abrasive

(Amount of chromium contained in abrasive)

= (annual consumption of abrasive containing chromium) × (chromium content)

= 250t/year × 1,000 × 1.4% ÷ 100

= 250,000 kg/year × 0.014

= 3,500 kg/year

B) Calculating the amount of chromium contained in mixing loss (transfer)

(Amount of chromium contained in mixing loss)

= A) × (mixing loss ratio)

= 3,500 kg/year × 0.2% ÷ 100

= 3,500 kg/year × 0.002

= 7.0 kg/year

C) Calculating the amount of chromium transferred to the next process

(Amount of chromium transferred to the next process)

= A) - B)
= 3,500 kg/year - 7 kg/year
= 3,493 kg/year

② Phenol in powder phenol resin

A) Calculating the amount of phenol contained in the bonding material

(Amount of phenol transferred from the bond blending process)

= C) in bond blending process (1)

= 5,844 kg/year

B) Calculating the amount of phenol contained in mixing loss (transfer)

(Amount of phenol contained in mixing loss)

= A) × (mixing loss ratio)

= 5,844 kg/year × 0.2% ÷ 100

= 5,844 kg/year × 0.002

= 11.7 kg/year

C) Calculating the amount of phenol transferred to the next process

(Amount of phenol transferred to the next process)

= A) - B)

= 5,844 kg/year - 12 kg/year

= 5,832 kg/year

③ Phenol in liquid phenol resin

A) Calculating the amount of phenol contained in the bond

(Amount of phenol contained in the bond)

= (annual amount of bond handled) × (content % of phenol in the bond)

= 20t/year × 1,000kg × 5.4% ÷ 100

= 20,000 kg/year × 0.054

= 1,080 kg/year

B) Calculating the amount of phenol contained in mixing loss (transfers)

(Amount of phenol contained in mixing loss)

= A) × (mixing loss ratio)

= 1,080 kg/year × 0.2% ÷ 100

= 1,080 kg/year × 0.002

= 2.2 kg/year

C) Calculating the amount of phenol transferred to the next process

(Amount of phenol transferred to the next process)

= A) - B)

= 1,080 kg/year - 2.2 kg/year

= 1,078 kg/year

Amount of phenol contained in mixing loss   11.7 kg/year + 2.2 kg/year = 13.9 kg/year

Amount of phenol transferred to the next process   5,832 kg/year + 1,078 kg/year = 6,910 kg/year

④ Manganese

A) Calculating the amount of manganese contained in the filler

(Amount of manganese transferred from the mixing process)

= C) in bond blending process (1)

= 2,997 kg/year

B) Calculating the amount of manganese contained in mixing loss (transfer)

(Amount of manganese contained in mixing loss)

= A) × (mixing loss ratio)

= 2,997 kg/year × 0.2% ÷ 100

= 2,997 kg/year × 0.002

= 6.0 kg/year

C) Calculating the amount of manganese transferred to the next process

(Amount of manganese transferred to the next process)

= A) - B)

= 2,997 kg/year - 6.0 kg/year
= 2,991 kg/year

(3) Molding process

Mixed materials for molding are formed into bonded abrasive products using a press, etc.

Possible transfer of PRTR chemicals includes the raw materials leftover after molding as losses and waste as rejection.

【Example of PRTR chemicals】 Bond of the phenol resin type

(Abrasive)	Chromium and trivalent chromium compounds
(Filler)	Manganese and its compounds
(Plasticizer)	Di-n-butyl phthalate
(Bond)	Phenol, formaldehyde, and hexamine

【Calculation procedure】

Transfers in the molding process are basically calculated as follows:

A) Calculation of the annual amount of PRTR chemical in molding material ⇐ Annual consumption of molding material × Content of PRTR chemical in molding material

↓

B) Calculation of the annual amount of PRTR chemical contained (transfers) in molding loss ⇐ Annual amount of molding material × Molding loss rate

↓

C) Calculation of the annual amount of PRTR chemical output to the next process ⇐ A) - B)

【Example of calculation】

① Chromium and trivalent chromium compounds (as chromium)

A) Calculating the amount of chromium contained in molding material

(Amount of chromium transferred from the mixing process)

= C) in mixing process (2)

= 3,493 kg/year

B) Calculating the amount of chromium contained in molding loss (transfers)

(Amount of chromium contained in molding loss)

= A) × ([molding loss ratio] + [molding rejection ratio])

= 3,493 kg/year × (0.2% + 0.1%) ÷ 100

= 3,493 kg/year × 0.003

= 10.5 kg/year

C) Calculating the amount of chromium transferred to the next process

(Amount of chromium transferred to the next process)

= A) - B)

= 3,493 kg/year - 11 kg/year

= 3,482 kg/year

② Phenol in powder phenol resin

A) Calculating the amount of phenol contained in molding material

(Amount of phenol transferred from the mixing process)

= C) in mixing process (2)

= 5,832 kg/year

B) Calculating the amount of phenol contained in molding loss

(Amount of phenol contained in molding loss)

= A) × ([molding loss ratio] + [molding rejection ratio])
= 5,832 kg/year × (0.2% + 0.1%) ÷ 100
= 5,832 kg/year × 0.003
= 17.5 kg/year

C) Calculating the amount of phenol transferred to the next process

(Amount of phenol transferred to the next process)

= A) - B)
= 5,832kg /year - 18 kg/year
= 5,814 kg/year

③ Phenol in liquid phenol resin

A) Calculating the amount of phenol contained in molding material

(Amount of phenol transferred from the mixing process)

= C) in mixing process (2)
= 1,078 kg/year

B) Calculating the amount of phenol contained in molding loss (transfers)

(Amount of phenol contained in molding loss)

= A) × ([molding loss ratio] + [molding rejection ratio])
= 1,078 kg/year × (0.2% + 0.1%) ÷ 100
= 1,078 kg/year × 0.003

= 3.2 kg/year

C) Calculating the amount of phenol transferred to the next process

(Amount of phenol transferred to the next process)

= A) - B)
= 1,078 kg/year - 3 kg/year
= 1,075 kg/year

Amount of phenol contained in molding loss	17.5 kg/year + 3.2 kg/year = 20.7 kg/year
Amount of phenol transferred to the next process	5,814 kg/year + 1,075 kg/year = 6,889 kg/year

④ Manganese

A) Calculating the amount of manganese contained in molding material

(Amount of manganese transferred from the mixing process)

= C) in mixing process (1)
= 2,991 kg/year

B) Calculating the amount of manganese contained in molding loss (transfer)

(Amount of manganese contained in molding loss)

= A) × ([molding loss ratio] + [molding rejection ratio])
= 2,991 kg/year × (0.2% + 0.1%) ÷ 100
= 2,991 kg/year × 0.003
= 9.0 kg/year

C) Calculating the amount of manganese transferred to the next process

(Amount of manganese transferred to the next process)

= A) - B)
= 2,991 kg/year - 9.0 kg/year
= 2,982 kg/year

(4) Baking process

This is a process for baking the molded green bonded abrasive products with the bond through a reaction at about 200°C.

Possible releases to the environment include PRTR chemicals that are evaporated during baking and released to the air. Possible transfer includes wastes (discarded charcoals, etc.) generated in the treatment of evaporated PRTR chemicals by exhaust gas treatment facilities that use activated charcoals, etc.

Possible forms of release to the environment include volatile components that are released to the air when losses and rejection in the bond blending, mixing, and molding processes are baked as wastes for disposal. Therefore, they are added to the amount handled.

【Example of PRTR chemicals】 Bond of the phenol resin type
(Bond) Phenol, formaldehyde, and hexamine

【Calculation procedure】
Releases and transfers in the baking process are basically calculated as follows:

A) Calculation of the annual amount of PRTR chemical in green bonded abrasive product ⇐ Annual amount of green bonded abrasive products handled × Content in molding material

↓

B) Calculation of the annual amount of PRTR chemical (transfers) in exhaust gas ⇐ A) × Emission factor

【Example of calculation】
① Phenol in powder phenol resin
A) Calculating the amount of phenol contained in green bonded abrasive products
(Amount of phenol contained in green bonded abrasive products)
= C) in molding process (3) + bond blending loss + mixing loss + molding loss
= 5,814 kg/year + 5.9 kg/year + 11.7 kg/year + 17.5 kg/year
= 5,849.1 kg/year
B) Calculating the amount of phenol contained in exhaust gas (releases)
(Amount of phenol contained in exhaust gas)
= A) × emission factor
= 5,849 kg/year × 2.2% ÷ 100
= 129 kg/year

② Phenol in liquid phenol resin
A) Calculating the amount of phenol contained in green bonded abrasive product
(Amount of phenol contained in green bonded abrasive product)
= C) in molding process (3) + mixing loss + molding loss
= 1,075 kg/year + 2.2 kg/year + 3.2 kg/year
= 1,080.4 kg/year
B) Calculating the amount of phenol contained in exhaust gas (releases)
(Amount of phenol contained in exhaust gas)
= A) × emission factor
= 1,080.4 kg/year × 10% ÷ 100
= 108 kg/year

(Amount of phenol contained in exhaust gas) (releases) = 129 kg/year + 108 kg/year
= 237 kg/year

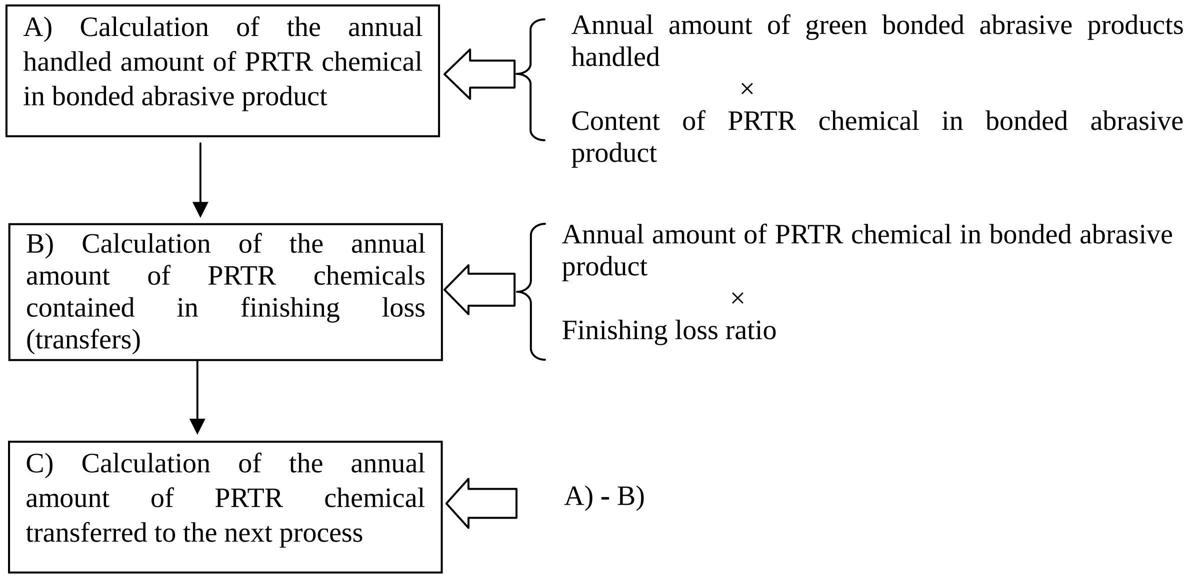
Since all volatile components are considered to evaporate from bonded abrasive product during baking, the phenol content in baked bonded abrasive product is assumed to be zero.

(5) Finishing process
This is a process for finishing the fired bonded abrasive products into prescribed shapes and dimensions. Possible forms of transfer include dust and rejection that are generated as wastes in the finishing process.

【Example of PRTR chemical chemicals】

Finishing dust	(Abrasive)	Chromium and trivalent chromium compounds
	(Filler)	Manganese and its compounds
	(Plasticizer)	Di-n-butyl phthalate
Finishing rejection	(Abrasive)	Chromium and trivalent chromium compounds
	(Filler)	Manganese and its compounds
	(Plasticizer)	Di-n-butyl phthalate

【Calculation procedure】



【Example of calculation】

① Chromium and trivalent chromium compounds (as chromium)

A) Calculating the amount of chromium contained in bonded abrasive product

(Amount of chromium transferred from the molding process)
= C) in molding process (3)
= 3,482 kg/year

B) Calculating the amount of chromium contained in finishing dust (transfers)

(Amount of chromium contained in finishing dust)
= A) × ([finishing dust] + [finishing rejection ratio])
= 3,482 kg/year × (3% + 0.5%) ÷ 100
= 3,482 kg/year × 0.035
= 122.0 kg/year

C) Calculating the amount of chromium transferred to the next process

(Amount of chromium transferred to the next process)
= A) - B)
= 3,482 kg/year - 122.0 kg/year
= 3,360 kg/year

② Manganese

A) Calculating the amount of manganese contained in bonded abrasive products

(Amount of manganese transferred from the molding process)
= C) in molding process (3)
= 2,982 kg/year

B) Calculating the amount of manganese contained in finishing dust (transfers)

(Amount of manganese contained in finishing dust)
= A) × ([finishing dust] + [finishing rejection ratio])
= 2,982 kg/year × (3% + 0.5%) ÷ 100
= 2,982 kg/year × 0.035
= 104.4 kg/year

C) Calculating the amount of manganese transferred to the next process

(Amount of manganese transferred to the next process)

= A) - B)

= 2,982 kg/year - 104 kg/year

= 2,878 kg/year

(5-2) Finishing holes process

The holes of finished bonded abrasive products are coated with metallic lead.

Possible releases to the environment include metallic lead used for coating that is released to the air. However, because the melting temperature is controlled at 450°C or less, it is assumed that there will be no lead fume and that release to the air can be ignored.

(5-3) Mounting process

Bonded abrasive products are mounted on the prescribed iron plates, etc.

Possible releases to the environment include the chemicals that are evaporated from the mounting agent to the air or that are transferred through the disposal of mounting agent. However, because the amount handled is small, release to the air and transfer through disposal require no notification.

(6) Inspection process

This is a process for checking bonding strength, degree of balancing, stability, size, and other items concerning finished bonded abrasive products.

Possible releases to the environment include rejection generated in the inspection process that is discarded. Metallic lead contained in rejection does not require notification because it is collected by the company or sold to a recycling agent. Mounted products do not require notification because their rejection ratio is very small.

【Example of PRTR chemicals】

Rejection ratio by inspection (Abrasive) Chromium and trivalent chromium compounds

(Filler) Manganese and its compounds

(Plasticizer) Di-n-butyl phthalate

【Calculation procedure】

A) Calculation of the annual amount of PRTR chemical in bonded abrasive products ⇐ Annual production of bonded abrasive products × Content of PRTR chemical in bonded abrasive products

↓

B) Calculation of the annual amount of PRTR chemical in rejection by inspection (transfers) ⇐ Annual amount in bonded abrasive products × Rejection ratio by inspection

↓

C) Calculation of the annual amount of PRTR chemical transferred to the next process ⇐ A) - B)

【Example of calculation】

① Chromium and trivalent chromium compounds (as chromium)

A) Calculating the amount of chromium contained in bonded abrasive products

(Amount of chromium transferred from the finishing process)

= C) in finishing process (5)

= 3,360 kg/year

B) Calculating the amount of chromium contained in rejection by inspection (transfers)

(Amount of chromium contained in rejection by inspection)
= A) × (rejection ratio by inspection)
= 3,360 kg/year × 0.5% ÷ 100
= 3,360 kg/year × 0.005
= 16.8 kg/year

C) Calculating the amount of chromium transferred to the next process
(Amount of chromium transferred to the next process)
= A) - B)
= 3,360 kg/year - 17 kg/year
= 3,343 kg/year

② Manganese

A) Calculating the amount of manganese contained in bonded abrasive products
(Amount of manganese transferred from the finishing process)
= C) in finishing process (5)
= 2,878 kg/year

B) Calculating the amount of manganese contained in rejection by inspection (transfers)
(Amount of manganese contained in rejection by inspection)
= A) × (rejection ratio by inspection)
= 2,878 kg/year × 0.5% ÷ 100
= 2,878 kg/year × 0.005
= 14.4 kg/year

C) Calculating the amount of manganese transferred to the next process
(Amount of manganese transferred to the next process)
= A) - B)
= 2,878 kg/year - 14.4 kg/year
= 2,864 kg/year

(6-2) Marking process

Finished bonded abrasive products are marked with paint that indicates their types, ill-balanced position balance, and high speeds.

Possible forms of release to the environment include PRTR chemicals that are released from the solvent components of the paint to the air. However, because the use amount is small, release to the air and transfer through disposal require no notification.

The total transfers as wastes from all processes are:

(Transfers of chromium) = (mixing loss) + (molding loss) + (finishing dust) + (rejection by inspection)
= 7.0 kg/year + 10.5 kg/year + 122.0 kg/year + 16.8 kg/year
= 156.3 kg/year

(Transfers of manganese) = (bond blending loss) + (mixing loss) + (molding loss) + (finishing dust) + (rejection by inspection)
= 3.0 kg/year + 6.0 kg/year + 9.0 kg/year + 104.4 kg/year + 14.4 kg/year
= 136.8 kg/year

Chapter 4 Reference

1. Class I Designated Chemical Substances (PRTR Chemicals)

Cabinet Order No.	CAS No.[*1]	Chemical name[*2]	Specified Class I Designated Chemical Substance (Specified PRTR chemical)[*3(	PRTR chemical used for bonded abrasive products[*4]	PRTR chemical referred to in this manual[*5]
1	-	zinc compounds (water-soluble)			
2	79-06-1	acrylamide			
3	79-10-7	acrylic acid			
4	140-88-5	ethyl acrylate			
5	2439-35-2	2-(dimethylamino)ethyl acrylate			
6	96-33-3	methyl acrylate			
7	107-13-1	acrylonitrile			
8	107-02-8	acrolein			
9	103-23-1	bis(2-ehtylhexyl) adipate			
10	111-69-3	adiponitrile			
11	75-07-0	acetaldehyde			
12	75-05-8	acetonitrile			
13	78-67-1	2,2'-azobisisobutyronitrile			
14	90-04-0	o-anisidine			
15	62-53-3	aniline			
16	141-43-5	2-aminoethanol			
17	111-40-0	N-(2-aminoethyl)-1,2-ethanediamine; diethylenetriamine		○	
18	120068-37-3	5-amino-1-[2,6-dichloro-4-(trifluoromethyl)phenyl]-3-cyano-4-[(trifluoromethyl)sulfinyl]pyrazole; fipronil			
19	61-82-5	3-amino-1H-1,2,4-triazole; amitrole			
20	51276-47-2	2-amino-4-[hydroxy(methyl)phosphinoyl]butyric acid; glufosinate			
21	591-27-5	m-aminophenol			
22	107-18-6	allyl alcohol			
23	106-92-3	1-allyloxy-2,3-epoxypropane			
24	-	n-alkylbenzenesulfonic acid and its			

Cabinet Order No.	CAS No.[*1]	Chemical name[*2]	Specified Class I Designated Chemical Substance (Specified PRTR chemical)[*3(	PRTR chemical used for bonded abrasive products[*4]	PRTR chemical referred to in this manual[*5]
		salts (alkyl C=10-14)			
25	-	antimony and its compounds		○	
26	1332-21-4	asbestos	○		
27	4098-71-9	3-isocyanatomethyl-3,5,5-trimethyl cyclohexyl isocyanate			
28	78-79-5	isoprene			
29	80-05-7	4,4'-isopropylidenediphenol; bisphenol A			
30	25068-38-6	polymer of 4,4'-isopropylidenediphenol and 1-chloro-2,3-epoxypropane (liquid); bisphenol A type epoxy resin (liquid)		○	○
31	4162-45-2	2,2'-{isopropylidenebis[(2,6-dibromo-4,1-phenylene)oxy]}diethanol			
32	96-45-7	2-imidazolidinethione			
33	13516-27-3	1,1'-[iminodi(octamethylene)]diguanidine; iminoctadine			
34	76578-14-8	ethyl 2-[4-(6-chloro-2-quinoxalinyloxy)phenoxy]propionate; quizalofop-ethyl			
35	25319-90-8	S-ethyl 2-(4-chloro-2-methylphenoxy)thioacetate; phenothiol; MCPA-thioethyl			
36	36335-67-8	O-ethyl O-(6-nitro-m-tolyl) sec-butylphosphoramidothioate; butamifos			
37	2104-64-5	O-ethyl O-4-nitrophenyl phenylphosphonothioate; EPN			
38	40487-42-1	N-(1-ethylpropyl)-2,6-dinitro-3,4-xylidine; pendimethalin			

Cabinet Order No.	CAS No.[*1]	Chemical name[*2]	Specified Class I Designated Chemical Substance (Specified PRTR chemical)[*3(	PRTR chemical used for bonded abrasive products[*4]	PRTR chemical referred to in this manual[*5]
39	2212-67-1	S-ethyl hexahydro-1H-azepine-1-carbothioate; molinate			
40	100-41-4	ethylbenzene		○	
41	151-56-4	ethyleneimine			
42	75-21-8	ethylene oxide	○		
43	107-21-1	ethylene glycol		○	
44	110-80-5	ethylene glycol monoethyl ether			
45	109-86-4	ethylene glycol monomethyl ether			
46	107-15-3	ethylenediamine			
47	60-00-4	ethylenediaminetetraacetic acid			
48	12122-67-7	zinc N,N'-ethylenebis(dithiocarbamate); zineb			
49	12427-38-2	manganese N,N'-ethylenebis(dithiocarbamate); maneb			
50	8018-01-7	complex compounds of manganese N,N'-ethylenebis(dithiocarbamate) and zinc N,N'-ethylenebis(dithiocarbamate); mancozeb			
51	85-00-7	1,1'-ethylene-2,2'-bipyridinium dibromide; diquat dibromide			
52	62-44-2	4'-ethoxyacetanilide; phenacetin			
53	2593-15-9	5-ethoxy-3-trichloromethyl-1,2,4-thiadiazole; echlomezol			
54	106-89-8	epichlorohydrin		○	
55	556-52-5	2,3-epoxy-1-propanol			
56	75-56-9	1,2-epoxypropane; propylene			

Cabinet Order No.	CAS No.[*1]	Chemical name[*2]	Specified Class I Designated Chemical Substance (Specified PRTR chemical)[*3(	PRTR chemical used for bonded abrasive products[*4]	PRTR chemical referred to in this manual[*5]
		oxide			
57	122-60-1	2,3-epoxypropyl phenyl ether			
58	111-87-5	1-octanol			
59	1806-26-4	p-octylphenol			
60	-	cadmium and its compounds	○		
61	105-60-2	epsilon-caprolactam			
62	576-26-1	2,6-xylenol			
63	1330-20-7	xylene		○	○
64	-	silver and its water-soluble compounds		○	
65	107-22-2	glyoxal			
66	111-30-8	glutaraldehyde			
67	1319-77-3	cresol		○	
68	-	chromium and chromium(III) compounds		○	○
69	-	chromium(VI) compounds	○		
70	79-04-9	chloroacetyl chloride			
71	95-51-2	o-chloroaniline			
72	106-47-8	p-chloroaniline			
73	108-42-9	m-chloroaniline			
74	75-00-3	chloroethane			
75	1912-24-9	2-chloro-4-ethylamino-6-isopropylamino-1,3,5-triazine; atrazine			
76	51218-45-2	2-chloro-2'-ethyl-N-(2-methoxy-1-methylethyl)-6'-methylacetanilide; metolachlor			
77	75-01-4	chloroethylene; vinyl chloride	○		
78	79622-59-6	3-chloro-N-(3-chloro-5-trifluoromethyl-2-pyridyl)-alpha,alpha,alpha-trifluoro-2,6-dinitro-p-toluidine;			

Cabinet Order No.	CAS No.*1	Chemical name*2	Specified Class I Designated Chemical Substance (Specified PRTR chemical)*3(	PRTR chemical used for bonded abrasive products*4	PRTR chemical referred to in this manual*5
		fluazinam			
79	119446-68-3	1-({2-[2-chloro-4-(4-chlorophenoxy) phenyl]-4-methyl-1,3-dioxolan-2-yl} methyl)-1H-1,2,4-triazole; difenoconazole			
80	79-11-8	chloroacetic acid			
81	51218-49-6	2-chloro-2',6'-diethyl-N-(2-propoxyethyl)acetanilide; pretilachlor			
82	15972-60-8	2-chloro-2',6'-diethy-N-(methoxymethyl)acetanilide; alachlor			
83	97-00-7	1-chloro-2,4-dinitrobenzene			
84	75-68-3	1-chloro-1,1-difluoroethane; HCFC-142b			
85	75-45-6	chlorodifluoromethane; HCFC-22			
86	2837-89-0	2-chloro-1,1,1,2-tetrafluoroethane; HCFC-124			
87	-	chlorotrifluoroethane; HCFC-133			
88	75-72-9	chlorotrifluoromethane; CFC-13			
89	95-49-8	o-chlorotoluene			
90	122-34-9	2-chloro-4,6-bis(ethylamino)-1,3,5-triazine; shimazine; CAT			
91	107-05-1	3-chloropropene; allyl chloride			
92	86598-92-7	4-chlorobenzyl N-(2,4-dichlorophenyl)-2-(1H-1,2,4-triazol-1-yl)thioacetimidate; imibenconazole			
93	108-90-7	chlorobenzene			
94	76-15-3	chloropentafluoroethane; CFC-115			
95	67-66-3	chloroform			
96	74-87-3	chloromethane; methyl chloride			
97	94-74-6	(4-chloro-2-methylphenoxy)acetic			

Cabinet Order No.	CAS No.[*1]	Chemical name[*2]	Specified Class I Designated Chemical Substance (Specified PRTR chemical)[*3(	PRTR chemical used for bonded abrasive products[*4]	PRTR chemical referred to in this manual[*5]
		acid; MCP; MCPA			
98	96491-05-3	2-chloro-N-(3-methoxy-2-thienyl)-2',6'-dimethylacetanilide; thenylchlor			
99	1314-62-1	divanadium pentaoxide			
100	-	cobalt and its compounds		○	
101	111-15-9	2-ethoxyethyl acetate; ethylene glycol monoethyl ether acetate			
102	108-05-4	vinyl acetate			
103	110-49-6	2-methoxyethyl acetate; ethylene glycol monomethyl ether acetate			
104	90-02-8	salicylaldehyde			
105	102851-06-9	alpha-cyano-3-phenoxybenzyl N-(2-chloro-alpha,alpha,alpha-trifluoro-p-tolyl)-D-valinate; fluvalinate			
106	51630-58-1	alpha-cyano-3-phenoxybenzyl 2-(4-chlorophenyl)-3-methylbutyrate; fenvalerate			
107	52315-07-8	alpha-cyano-3-phenoxybenzyl 3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate; cypermethrin			
108	-	inorganic cyanide compounds (except complex salts and cyanates)			
109	100-37-8	2-(diethylamino)ethanol			
110	28249-77-6	S-4-chlorobenzyl N,N-diethylthiocarbamate; thiobencarb			
111	125306-83-4	N,N-diethyl-3-(2,4,6-trimethylphenylsulfonyl)-1H-1,2,4-triazole-1-carboxamide; cafenstrole			

Cabinet Order No.	CAS No.[*1]	Chemical name[*2]	Specified Class I Designated Chemical Substance (Specified PRTR chemical)[*3(	PRTR chemical used for bonded abrasive products[*4]	PRTR chemical referred to in this manual[*5]
112	56-23-5	tetrachloromethane			
113	123-91-1	1,4-dioxane			
114	108-91-8	cyclohexylamine			
115	95-33-0	N-cyclohexyl-2-benzothiazolesulfe namide			
116	107-06-2	1,2-dichloroethane			
117	75-35-4	1,1-dichloroethylene; vinylydene dichloride			
118	156-59-2	cis-1,2-dichloroethylene			
119	156-60-5	trans-1,2-dichloroethylene			
120	101-14-4	3,3'-dichloro-4,4'-diaminodiphenyl methane		○	
121	75-71-8	dichlorodifluoromethane; CFC-12			
122	23950-58-5	3,5-dichloro-N-(1,1-dimethyl-2-prop ynyl)benzamide; propyzamide			
123	-	dichlorotetrafluoroethane; CFC-114			
124	306-83-2	2,2-dichloro-1,1,1-trifluoroethane; HCFC-123			
125	106917-52-6	2',4-dichloro-alpha,alpha,alpha-trifl uoro-4'-nitro-m-toluenesulfonanilid e; flusulfamide			
126	82692-44-2	2-[4-(2,4-dichloro-m-toluoyl)-1,3-di methyl-5-pyrazolyloxy]-4-methylac etophenone; benzofenap			
127	3209-22-1	1,2-dichloro-3-nitrobenzene			
128	89-61-2	1,4-dichloro-2-nitrobenzene			
129	330-54-1	3-(3,4-dichlorophenyl)-1,1-dimethyl urea; diuron; DCMU			
130	330-55-2	3-(3,4-dichlorophenyl)-1-methoxy-1 -methylurea; linuron			

Cabinet Order No.	CAS No.[*1]	Chemical name[*2]	Specified Class I Designated Chemical Substance (Specified PRTR chemical)[*3(	PRTR chemical used for bonded abrasive products[*4]	PRTR chemical referred to in this manual[*5]
131	94-75-7	2,4-dichlorophenoxyacetic acid; 2,4-D; 2,4-PA			
132	1717-00-6	1,1-dichloro-1-fluoroethane; HCFC-141b		○	
133	75-43-4	dichlorofluoromethane; HCFC-21			
134	96-23-1	1,3-dichloro-2-propanol			
135	78-87-5	1,2-dichloropropane			
136	709-98-8	3',4'-dichloropropionanilide; propanil; DCPA			
137	542-75-6	1,3-dichloropropene; D-D			
138	91-94-1	3,3'-dichlorobenzidine			
139	95-50-1	o-dichlorobenzene			
140	106-46-7	p-dichlorobenzene		○	
141	71561-11-0	2-[4-(2,4-dichlorobenzoyl)-1,3-dimethyl-5-pyrazolyloxy]acetophenone; pyrazoxyfen			
142	58011-68-0	4-(2,4-dichlorobenzoyl)-1,3-dimethyl-5-pyrazolyl 4-toluenesulfonate; pyrazolynate			
143	1194-65-6	2,6-dichlorobenzonitrile; dichlobenil; DBN			
144	-	dichloropentafluoropropane; HCFC-225			
145	75-09-2	dichloromethane; methylene dichloride		○	
146	3347-22-6	2,3-dicyano-1,4-dithiaanthraquinone; dithianon			
147	50512-35-1	diisopropyl 1,3-dithiolan-2-ylidenemalonate; isoprothiolane			
148	17109-49-8	O-ethyl S,S-diphenyl			

Cabinet Order No.	CAS No.[*1]	Chemical name[*2]	Specified Class I Designated Chemical Substance (Specified PRTR chemical)[*3](	PRTR chemical used for bonded abrasive products[*4]	PRTR chemical referred to in this manual[*5]
		phosphorodithioate; edifenphos; EDDP			
149	640-15-3	S-2-(ethylthio)ethyl O,O-dimethyl phosphorodithioate; thiometon			
150	35400-43-2	O-ethyl O-4-(methylthio)phenyl S-n-propyl phosphorodithioate; sulprofos			
151	298-04-4	O,O-diethyl S-2-(ethylthio)ethyl phosphorodithioate; ethylthiometon; disulfoton			
152	2310-17-0	O,O-diethyl S-(6-chloro-2,3-dihydro-2-oxobenz oxazolinyl)methyl phosphorodithioate; phosalone			
153	34643-46-4	O-2,4-dichlorophenyl O-ethyl S-propyl phosphorodithioate; prothiofos			
154	950-37-8	S-(2,3-dihydro-5-methoxy-2-oxo-1, 3,4-thiadiazol-3-yl)methyl O,O-dimethyl phosphorodithioate; methidathion; DMTP			
155	121-75-5	O,O-dimethyl S-1,2-bis(ethoxycarbonyl)ethyl phosphorodithioate; malathon; malathion			
156	60-51-5	O,O-dimethyl S-(N-methylcarbamoyl)methyl phosphorodithioate; dimethoate			
157	25321-14-6	dinitrotoluene			
158	51-28-5	2,4-dinitrophenol			
159	122-39-4	diphenylamine			
160	102-81-8	2-(di-n-butylamino)ethanol			

Cabinet Order No.	CAS No.*1	Chemical name*2	Specified Class I Designated Chemical Substance (Specified PRTR chemical)*3(	PRTR chemical used for bonded abrasive products*4	PRTR chemical referred to in this manual*5
161	55285-14-8	2,3-dihydro-2,2-dimethyl-7-benzo[b]furyl N-(dibutylamino)thio-N-methylcarbamate; carbosulfan			
162	-	dibromotetrafluoroethane; halone-2402			
163	87-62-7	2,6-dimethylaniline			
164	95-64-7	3,4-dimethylaniline			
165	62850-32-2	S-4-phenoxybutyl N,N-dimethylthiocarbamate; phenothiocarb			
166	1643-20-5	N,N-dimethyldodecylamine N-oxide			
167	52-68-6	dimethyl 2,2,2-trichloro-1-hydroxyethylphosphonate; trichlorfon; DEP			
168	4685-14-7	1,1'-dimethyl-4,4'-bipyridinium salts (except paraquat dichloride)			
169	1910-42-5	1,1'-dimethyl-4,4'-bipyridinium dichloride; paraquat; paraquat dichloride			
170	85785-20-2	S-benzyl N-(1,2-dimethylpropyl)-N-ethylthiocarbamate; esprocarb			
171	119-93-7	3,3'-dimethylbenzidine; o-tolidine			
172	68-12-2	N,N-dimethylformamide		○	
173	2597-03-7	ethyl 2-[(dimethoxyphosphinothioyl)thio]-2-phenylacetate; phenthoate; PAP			
174	3861-47-0	3,5-diiodo-4-octanoyloxybenzonitrile; ioxynil octanoate			

Cabinet Order No.	CAS No.[*1]	Chemical name[*2]	Specified Class I Designated Chemical Substance (Specified PRTR chemical)[*3(	PRTR chemical used for bonded abrasive products[*4]	PRTR chemical referred to in this manual[*5]
175	-	mercury and its compounds			
176	-	organic tin compounds			
177	100-42-5	styrene		○	
178	-	selenium and its compounds			
179	-	dioxins	○		
180	533-74-4	2-thioxo-3,5-dimethyltetrahydro-2H -1,3,5-thiadiazine; dazomet			
181	62-56-6	thiourea			
182	108-98-5	thiophenol			
183	77458-01-6	O-1-(4-chlorophenyl)-4-pyrazolyl O-ethyl S-propyl phosphorothioate; pyraclofos			
184	2636-26-2	O-4-cyanophenyl O,O-dimethyl phosphorothioate; cyanophos; CYAP			
185	333-41-5	O,O-diethyl O-2-isopropyl-6-methyl-4-pyrimidinyl phosphorothioate; diazinon			
186	119-12-0	O,O-diethyl O-6-oxo-1-phenyl-1,6-dihydro-3-pyridazinyl phosphorothioate; pyridaphenthion			
187	13593-03-8	O,O-diethyl O-2-quinoxalinyl phosphorothioate; quinalphos			
188	2921-88-2	O,O-diethyl O-3,5,6-trichloro-2-pyridyl phosphorothioate; chlorpyrifos			
189	18854-01-8	O,O-diethyl O-5-phenyl-3-isoxazolyl phosphorothioate; isoxathion			
190	97-17-6	O-2,4-dichlorophenyl O,O-diethyl			

Cabinet Order No.	CAS No.*1	Chemical name*2	Specified Class I Designated Chemical Substance (Specified PRTR chemical)*3(	PRTR chemical used for bonded abrasive products*4	PRTR chemical referred to in this manual*5
		phosphorothioate; dichlofenthion; ECP			
191	2275-23-2	O,O-dimethyl S-2-[1-(N-methylcarbamoyl)ethylthio]ethyl phosphorothioate; vamidothion			
192	122-14-5	O,O-dimethyl O-3-methyl-4-nitrophenyl phosphorothioate; fenitrothion; MEP			
193	55-38-9	O,O-dimethyl O-3-methyl-4-(methylthio)phenyl phosphorothioate; fenthion; MPP			
194	5598-13-0	O-3,5,6-trichloro-2-pyridyl O,O-dimethyl phosphorothioate; chlorpyrifos-methyl			
195	41198-08-7	O-4-bromo-2-chlorophenyl O-ethyl S-propyl phosphorothioate; profenofos			
196	26087-47-8	S-benzyl O,O-diisopropyl phosphorothioate; iprobenfos; IBP			
197	1163-19-5	decabromodiphenyl ether			
198	100-97-0	1,3,5,7-tetraazatricyclo[3.3.1.1$^{3.7}$]decane; hexamethylenetetramine		○	○
199	1897-45-6	tetrachloroisophthalonitrile; chlorothalonil; TPN			
200	127-18-4	tetrachloroethylene		○	
201	-	tetrachlorodifluoroethane; CFC-112			
202	11070-44-3	tetrahydromethylphthalic anhydride			
203	116-14-3	tetrafluoroethylene			

Cabinet Order No.	CAS No.*1	Chemical name*2	Specified Class I Designated Chemical Substance (Specified PRTR chemical)*3(	PRTR chemical used for bonded abrasive products*4	PRTR chemical referred to in this manual*5
204	137-26-8	tetramethylthiuram disulfide; thiram			
205	100-21-0	terephthalic acid			
206	120-61-6	dimethyl terephthalate		○	
207	-	copper salts (water-soluble, except complex salts)			
208	75-87-6	trichloroacetaldehyde			
209	71-55-6	1,1,1-trichloroethane			
210	79-00-5	1,1,2-trichloroethane			
211	79-01-6	trichloroethylene		○	
212	108-77-0	2,4,6-trichloro-1,3,5-triazine			
213	-	trichlorotrifluoroethane; CFC-113			
214	76-06-2	trichloronitromethane; chloropicrin			
215	115-32-2	2,2,2-trichloro-1,1-bis(4-chlorophen yl)ethanol; kelthane; dicofol			
216	55335-06-3	(3,5,6-trichloro-2-pyridyl)oxyacetic acid; triclopyr			
217	75-69-4	trichlorofluoromethane; CFC-11			
218	2451-62-9	1,3,5-tris(2,3-epoxypropyl)-1,3,5-tri azine-2,4,6(1H,3H,5H)-trione			
219	118-96-7	2,4,6-trinitrotoluene			
220	1582-09-8	alpha,alpha,alpha-trifluoro-2,6-dinit ro-N,N-dipropyl-p-toluidine; trifluralin		○	
221	118-79-6	2,4,6-tribromophenol			
222	75-25-2	tribromomethane; bromoform			
223	3452-97-9	3,5,5-trimethyl-1-hexanol			
224	108-67-8	1,3,5-trimethylbenzene			
225	95-53-4	o-toluidine			
226	106-49-0	p-toluidine			
227	108-88-3	toluene		○	○

Cabinet Order No.	CAS No.*1	Chemical name*2	Specified Class I Designated Chemical Substance (Specified PRTR chemical)*3(	PRTR chemical used for bonded abrasive products*4	PRTR chemical referred to in this manual*5
228	95-80-7	2,4-toluenediamine			
229	52570-16-8	2-(2-naphthyloxy)propionanilide; naproanilide			
230	-	lead and its compounds		○	○
231	7440-02-0	nickel		○	
232	-	nickel compounds	○	○	
233	139-13-9	nitrilotriacetic acid			
234	100-01-6	p-nitroaniline			
235	628-96-6	nitroglycol			
236	55-63-0	nitroglycerin			
237	100-00-5	p-nitrochlorobenzene			
238	86-30-6	N-nitrosodiphenylamine			
239	100-02-7	p-nitrophenol			
240	98-95-3	nitrobenzene			
241	75-15-0	carbon disulfide			
242	25154-52-3	nonylphenol			
243	-	barium and its water-soluble compounds		○	
244	88-89-1	picric acid			
245	1014-70-6	2,4-bis(ethylamino)-6-methylthio-1,3,5-triazine; simetryn			
246	10380-28-6	bis(8-quinolinolato)copper; oxine-copper			
247	74115-24-5	3,6-bis(2-chlorophenyl)-1,2,4,5-tetrazine; clofentezine			
248	563-12-2	S,S'-methylene O,O,O',O'-tetraethyl bis(phosphorodithioate); ethion			
249	137-30-4	zinc bis(N,N'-dimethyldithiocarbamate);			

Cabinet Order No.	CAS No.[*1]	Chemical name[*2]	Specified Class I Designated Chemical Substance (Specified PRTR chemical)[*3(	PRTR chemical used for bonded abrasive products[*4]	PRTR chemical referred to in this manual[*5]
		ziram			
250	64440-88-6	N,N'-ethylenebis(thiocarbamoylthio zinc) bis(N,N-dimethyldithiocarbamate); polycarbamate			
251	61789-80-8	bis(hydrogenated tallow)dimethylammonium chloride			
252	-	arsenic and its inorganic compounds	○		
253	302-01-2	hydrazine			
254	123-31-9	hydroquinone			
255	100-40-3	4-vinyl-1-cyclohexene			
256	100-69-6	2-vinylpyridine			
257	55179-31-2	1-(4-biphenylyloxy)-3,3-dimethyl-1-(1H-1,2,4-triazol-1-yl)-2-butanol; bitertanol			
258	110-85-0	piperazine			
259	110-86-1	pyridine			
260	120-80-9	pyrocatechol			
261	96-09-3	phenyloxirane			
262	95-54-5	o-phenylenediamine			
263	106-50-3	p-phenylenediamine			
264	108-45-2	m-phenylenediamine			
265	156-43-4	p-phenetidine			
266	108-95-2	phenol		○	○
267	52645-53-1	3-phenoxybenzyl 3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate; permethrin			
268	106-99-0	1,3-butadiene			
269	117-84-0	di-n-octyl phthalate			

Cabinet Order No.	CAS No.[*1]	Chemical name[*2]	Specified Class I Designated Chemical Substance (Specified PRTR chemical)[*3(	PRTR chemical used for bonded abrasive products[*4]	PRTR chemical referred to in this manual[*5]
270	84-74-2	di-n-butyl phthalate		○	○
271	3648-21-3	di-n-heptyl phthalate			
272	117-81-7	bis(2-ethylhexyl) phthalate		○	
273	85-68-7	n-butyl benzyl phthalate			
274	69327-76-0	2-tert-butylimino-3-isopropyl-5-phenyltetrahydro-4H-1,3,5-thiadiazin-4-one; buprofezin			
275	112410-23-8	N-tert-butyl-N'-(4-ethylbenzoyl)-3,5-dimethylbenzohydrazide; tebufenozide			
276	17804-35-2	methyl N-[1-(N-n-butylcarbamoyl)-1H-2-benzimidazolyl]carbamate; benomyl			
277	122008-85-9	butyl (R)-2-[4-(4-cyano-2-fluorophenoxy)phenoxy]propionate; cyhalofop-butyl			
278	134098-61-6	tert-butyl 4-({[(1,3-dimethyl-5-phenoxy-4-pyrazolyl)methylidene]aminooxy}methyl)benzoate; fenpyroximate			
279	2312-35-8	2-(4-tert-butylphenoxy)cyclohexyl 2-propynyl sulfite; propargite; BPPS			
280	96489-71-3	2-tert-butyl-5-(4-tert-butylbenzylthio)-4-chloro-3(2H)-pyridazinone; pyridaben			
281	119168-77-3	N-(4-tert-butylbenzyl)-4-chloro-3-ethyl-1-methylpyrazole-5-carboxamide; tebufenpyrad			
282	95-31-8	N-(tert-butyl)-2-benzothiazolesulfenamide			

Cabinet Order No.	CAS No.*1	Chemical name*2	Specified Class I Designated Chemical Substance (Specified PRTR chemical)*3(	PRTR chemical used for bonded abrasive products*4	PRTR chemical referred to in this manual*5
283	-	hydrogen fluoride and its water-soluble salts			
284	12071-83-9	polymer of N,N'-propylenebis(dithiocarbamic acid) and zinc; propineb			
285	353-59-3	bromochlorodifluoromethane; halone-1211			
286	75-63-8	bromotrifluoromethane; halone-1301			
287	75-26-3	2-bromopropane			
288	74-83-9	bromomethane; methyl bromide			
289	13356-08-6	hexakis(2-methyl-2-phenylpropyl)distannoxane; fenbutatin oxide			
290	115-28-6	1,4,5,6,7,7-hexachlorobicyclo[2.2.1]-5-heptene-2,3-dicarboxylic acid; chlorendic acid			
291	115-29-7	6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-2,4,3-benzodioxathiepine 3-oxide; endosulfan			
292	124-09-4	hexamethylenediamine		○	○
293	822-06-0	hexamethylene diisocyanate			
294	-	beryllium and its compounds	○		
295	98-07-7	benzylidyne trichloride	○		
296	98-87-3	benzylidene dichloride			
297	100-44-7	benzyl chloride			
298	100-52-7	benzaldehyde		○	
299	71-43-2	benzene	○	○	
300	552-30-7	1,2,4-benzenetricarboxylic 1,2-anhydride			
301	73250-68-7	2-(2-benzothiazolyloxy)-N-methyla			

Cabinet Order No.	CAS No.[*1]	Chemical name[*2]	Specified Class I Designated Chemical Substance (Specified PRTR chemical)[*3(	PRTR chemical used for bonded abrasive products[*4]	PRTR chemical referred to in this manual[*5]
		cetanilide; mefenacet			
302	82-68-8	pentachloronitrobenzene; quintozene; PCNB			
303	87-86-5	pentachlorophenol			
304	-	boron and its compounds		○	○
305	75-44-5	phosgene			
306	1336-36-3	polychlorinated biphenyls; PCBs			
307	-	poly(oxyethylene) alkyl ether (alkyl C=12-15)			
308	9036-19-5	poly(oxyethylene) octylphenyl ether			
309	9016-45-9	poly(oxyethylene) nonylphenyl ether			
310	50-00-0	formaldehyde		○	○
311	-	manganese and its compounds		○	○
312	85-44-9	phthalic anhydride			
313	108-31-6	maleic anhydride			
314	79-41-4	methacrylic acid			
315	688-84-6	2-ethylhexyl methacrylate			
316	106-91-2	2,3-epoxypropyl methacrylate			
317	105-16-8	2-(diethylamino)ethyl methacrylate			
318	2867-47-2	2-(dimethylamino)ethyl methacrylate			
319	97-88-1	n-butyl methacrylate			
320	80-62-6	methyl methacrylate			
321	126-98-7	methacrylonitrile			
322	89269-64-7	(Z)-2'-methylacetophenone 4,6-dimethyl-2-pyrimidinylhydrazone; ferimzone			
323	100-61-8	N-methylaniline			

Cabinet Order No.	CAS No.*1	Chemical name*2	Specified Class I Designated Chemical Substance (Specified PRTR chemical)*3(	PRTR chemical used for bonded abrasive products*4	PRTR chemical referred to in this manual*5
324	556-61-6	methyl isothiocyanate			
325	2631-40-5	2-isopropylphenyl N-methylcarbamate; isoprocarb; MIPC			
326	114-26-1	2-isopropoxyphenyl N-methylcarbamate; propoxur; PHC			
327	1563-66-2	2,3-dihydro-2,2-dimethyl-7-benzo[b]furanyl N-methylcarbamate; carbofuran			
328	2655-14-3	3,5-dimethylphenyl N-methylcarbamate; XMC			
329	63-25-2	1-naphthyl N-methylcarbamate; carbaryl; NAC			
330	3766-81-2	2-sec-butylphenyl N-methylcarbamate; fenobucarb; BPMC			
331	100784-20-1	methyl 3-chloro-5-(4,6-dimethoxy-2-pyrimidinylcarbamoylsulfamoyl)-1-methylpyrazole-4-carboxylate; halosulfuron-methyl			
332	33089-61-1	3-methyl-1,5-di(2,4-xylyl)-1,3,5-triazapenta-1,4-diene; amitraz			
333	144-54-7	N-methyldithiocarbamic acid; carbam			
334	2439-01-2	6-methyl-1,3-dithiolo[4,5-b]quinoxalin-2-one			
335	98-83-9	alpha-methylstyrene			
336	108-99-6	3-methylpyridine			
337	61432-55-1	S-1-methyl-1-phenylethyl 1-piperidinecarbothioate;			

Cabinet Order No.	CAS No.[*1]	Chemical name[*2]	Specified Class I Designated Chemical Substance (Specified PRTR chemical)[*3(	PRTR chemical used for bonded abrasive products[*4]	PRTR chemical referred to in this manual[*5]
		dimepiperate			
338	26471-62-5	methyl-1,3-phenylene diisocyanate; m-tolylene diisocyanate			
339	88-85-7	2-(1-methylpropyl)-4,6-dinitrophenol			
340	101-77-9	4,4'-methylenedianiline			
341	5124-30-1	methylenebis(4,1-cyclohexylene) diisocyanate			
342	88678-67-5	O-3-tert-butylphenyl N-(6-methoxy-2-pyridyl)-N-methylthiocarbamate; pyributicarb			
343	298-81-7	9-methoxy-7H-furo[3,2-g][1]benzopyran-7-one; methoxsalen	○		
344	120-71-8	2-methoxy-5-methylaniline			
345	68-11-1	mercaptoacetic acid			
346	-	molybdenum and its compounds		○	
347	470-90-6	2-chloro-1-(2,4-dichlorophenyl)vinyl diethyl phosphate; chlorfenvinphos; CVP			
348	2274-67-1	2-chloro-1-(2,4-dichlorophenyl)vinyl dimethyl phosphate; dimethylvinphos			
349	300-76-5	1,2-dibromo-2,2-dichloroethyl dimethyl phosphate; naled; BRP			
350	62-73-7	dimethyl 2,2-dichlorovinyl phosphate; dichlorvos; DDVP			
351	6923-22-4	dimethyl (E)-1-methyl-2-(N-methylcarbamoyl)vinyl phosphate; monocrotophos			
352	115-96-8	tris(2-chloroethyl) phosphate			

Cabinet Order No.	CAS No.[*1]	Chemical name[*2]	Specified Class I Designated Chemical Substance (Specified PRTR chemical)[*3(	PRTR chemical used for bonded abrasive products[*4]	PRTR chemical referred to in this manual[*5]
353	25155-23-1	tris(dimethylphenyl) phosphate			
354	126-73-8	tri-n-butyl phosphate			

*1 This is a registry number assigned to a chemical substance by the Chemical Abstracts Service, a division of the American Chemical Society. CAS numbers identify specific chemicals having different names. CAS Registry Numbers are an effective means for searching chemical information and are widely used throughout the world

*2 "Chemical name" is from Attached Table 1 in the Enforcement Regulation (Cabinet Order No.138 in 2000) for the Law Concerning Reporting, etc. of Releases to the Environment of Specific Chemical Chemicals and Promoting Improvements in Their Management. It should be noted that chemicals may have other names.

*3 "Specified Class I Designated Chemical Chemicals" are from Article 4 of the Enforcement Regulation for the Law Concerning Reporting, etc. of Releases to the Environment of Specific Chemical Chemicals and Promoting Improvements in Their Management.

*4 PRTR chemicals used for bonded abrasive products. (Japan Grinding Wheel Association, October 21, 2003)

*5 PRTR chemicals stated in the manual.

*6 "Water soluble" means that the chemical dissolves to 1 mass % or more (10 g/L or more) in neutral (pH7) water of room temperature (25°C).

2. Class II Designated Chemical Substances

The English description here is omitted.