

## Activities in the Product Environment

# Product Assessment

To minimise the adverse environmental effects of our products throughout their life cycles (see diagram at right), Nikon formulated its own product assessment system in 1995. This system makes it possible to quantify the degree of reduction of environmental impact during product development.

From 1995 we implemented this system in all product development and design departments, in order to gradually decrease environmental loading caused by our products.

Nikon is constantly adding items and standards for assessment. In fiscal 2005, we introduced a revised product assessment system (7<sup>th</sup> edition) that introduces stricter standards toward the improvement of harmful substance management, such as surface treatment. Our

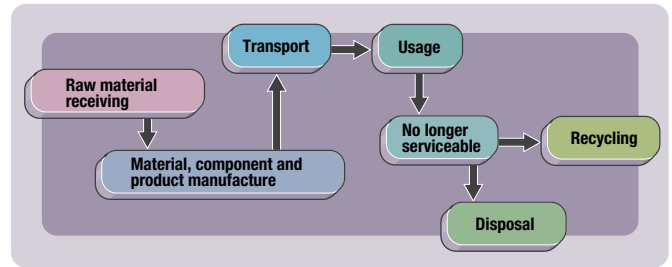
### Features of Nikon Product Assessment System

- Priority placed on reducing consumption of resources and energy; recycling; long product life; reduction in use of harmful substances; reduction and simplified processing of waste; disclosure of material information.
- Anticipation of emerging environmental issues and regulations in each country, and development of Nikon standards that take the characteristics of our products into account.
- Formulated after thorough discussion among product development teams, material engineers and other related personnel.
- Make product assessment mandatory in design reviews and related phases of product development sequences, with procedures and standards clearly defined.
- Continuous revision through item addition and improvement; Version 4 is currently in use.
- Vigilance in product improvement from one model to the next.
- Support designers by building and maintaining an environmental database of material information (eco-glass, flame retardants, etc.), explanatory text and documentation.

### Contents of the Nikon Product Assessment

- Continuing reduction in product mass, volume, and part count.
- Assessment and improvement of energy consumption based on Nikon's "Power Consumption Efficiency" formula (product functionality/power consumed).
- Pursuit of extended product life and simpler repair.
- Reduction in amount of waste generated from consumables; appropriate customer guidance on waste processing.
- Promotion of recycling of secondary batteries (simplified removal, content marking and explanations).
- Simplified separation of plastics and metals.
- Disclosure of material used (display to parts pursuant to ISO11469, International Standard for plastic materials).
- Elimination of specific brominated flame retardants (suppression of dioxin in waste processing).
- Reduction in use of PVC (added chlorine and lead, cadmium and phthalates can cause problems after waste disposal).
- Elimination of ozone layer-depleting substances (specified CFCs and alternative substances).
- Reduction in use of harmful substances (heavy metals in materials such as metal, resin, electric wire, electronic components, etc.).
- Implementation of lead-free solder on boards for electronic components. (page 14)
- Introduce technologies free of harmful heavy metals such as hexavalent chrome for surface treatment such as coating and plating (page 14).
- Use of optical glass free of lead and arsenic in optical system

### General life cycle for Nikon products



development and design divisions intend to redouble their efforts with the goal of a more favourable evaluation in the newest edition.

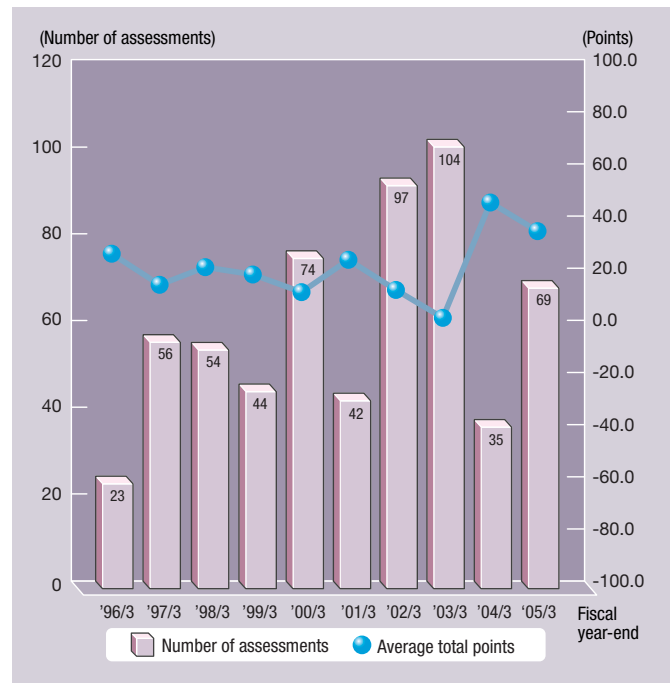
### Nikon Product Assessment Record

If a product shows improvement in terms of environmental friendliness when compared with the prior model, assessment points are awarded. If the product is about the same, no points are given. If it has deteriorated, points are subtracted. The assessment point scale ranges from -100 to +100.

For the 10-year period from fiscal 1996 to fiscal 2005, a total of 592 assessments were made under this programme, with an average assessment of +17.0 points.

Nikon is continuing its efforts to improve and enhance the functionality and performance of all of its products, while releasing new products to world markets, and this assessment indicates that our environmental efforts are gradually being rewarded.

### Product Assessment Results (through FY2005)



- components such as lens elements (page 13).
- Strict observance of environmental laws and regulations.
- Overall assessment (comments on degree of improvement, overall assessment points, etc.).

- [Eco-glass usage ratio]  
 • Use of Eco-glass in 100% of all optical designs for consumer products, and at least 94% for industrial products.



## Activities in the Product Environment

# Environmentally Sound Optical Glass (Eco-glass)

Nikon began full-scale work on the development of lead- and arsenic-free Eco-glass in 1995. We are employing this new glass in all of our product categories that incorporate optical systems — IC steppers, cameras, microscopes and so on. Nikon is working to

minimise the risk of environmental pollution (air, water, soil and waste disposal sites) caused by optical glass containing lead and arsenic, as far as possible throughout the entire product life cycle (raw material production, manufacturing, use and disposal).

## History of Eco-glass Development

Since Nikon was established in 1917 as the first optical glass manufacturer in Japan, we have placed a high priority on the development and manufacture of optical glass designed for use in optical equipment.

As part of our anti-pollution efforts, in the 1970s we ceased the use of cadmium — a toxic material — in optical glass.

In the 1990s, we investigated countless optical glass compositions, bearing in mind the possible effects of each on the environment.

Approximately 100 types of optical glass contained lead or arsenic. We have recognised that this fact is one of the most significant environmental aspects of our business activities and products.

Therefore, we decided to develop a new environmentally sound glass and employ it in our products.

We demanded that the new glass offer optical performance at least equalling that of the glass in use. As such, the optical glass development

department and the optical design department initiated a joint effort to investigate a variety of new compositions and design factors. After development was completed and the supply stance solidified, we began introducing Eco-glass into our products. Since 1998, we have used the new glass across the board in our optical design department. From the second half of fiscal 2005, we managed to use Eco-glass in all Imaging Company products, such as cameras.

The Nikon Group is undergoing a major shift to Eco-glass in the glass manufacturing departments of Nikon and Hikari Glass. During fiscal 2005, we achieved an Eco-glass utilisation rate of over 90% of all glasses shipped, at least 1,000t, including to non-affiliated companies.

Nikon offers an extensive range of optical equipment and, given this diversity, some products incorporate parts that may not accommodate Eco-glass. As far as technically possible, however, we intend to switch over to the new material.

## Eco-glass Development Highlights

- Fiscal 1996 Eco-glass development project launched full-scale.
- Fiscal 1998 Eco-glass-related items added to Nikon product assessments.
- Fiscal 1999 Eco-glass database completed; employed across the board in optical design.
- Fiscal 2000 Development of Eco-glass composition about 80% complete.
- Fiscal 2001 Development of Eco-glass composition complete.

The total cost for R&D to develop Eco-glass is 410 million yen during this term.



Eco-glass development

## Rates of Eco-glass utilisation in new optical designs

(Rates are calculated based on component units.)

	All products	Consumer products (Cameras, binoculars, etc.)	Industrial products (IC steppers, microscopes, etc.)
Fiscal 2000	77.1 %	-	-
Fiscal 2001	86.1 %	-	-
Fiscal 2002	78.1 %	-	-
Fiscal 2003	92.2 %	-	-
Fiscal 2004	94.7 %	96.6 %	94.5 %
Fiscal 2005	95.8 %	100 %	95.5 %

## Rates of Eco-glass utilisation in glass manufacturing department

(Rates are calculated based on amount of all materials shipped)

Fiscal 2001	53.6% (glass manufacturing at Nikon)
Fiscal 2002	75.8% (glass manufacturing at Nikon)
Fiscal 2003	83.5% (glass manufacturing at Nikon)
Fiscal 2004	87.4% (839/960t) (glass manufacturing at Nikon and Hikari Glass)
Fiscal 2005	91.7% (989/1,079t) (glass manufacturing at Nikon and Hikari Glass)

# Lead-free Solder, Surface Treatment, Reductions in Harmful Substance Usage

## Targets

- [Lead-free solder]
  - Use of lead-free printed circuit boards for electronic components in more than 50% of consumer products and at least 20% of new industrial products. [Hexavalent chrome, lead, cadmium, mercury, PBB, PBDE, PVC]
  - Major reduction in levels of the above hazardous substances in consumer products.



To minimise harmful substances, Nikon is promoting the use of lead-free solder in our electronic equipment as well as that produced by our Group and cooperative companies. We are also developing technologies to eliminate the use of hexavalent chrome

in the surface treatment of metal, and implementing technologies to reduce the use of heavy metals in coatings, inks and surface treatment.

## Developments in Lead-Free Solder

We have been installing new equipment on electronics production lines at our Yokohama plant, Sendai Nikon and other sites. We are also advancing experimentation, prototyping and evaluation of lead-free solder on electronics printed circuit boards in each product category. There have been considerable technical obstacles to overcome, and we are standardising and sharing the expertise we have gained with our product development and manufacturing technologies teams, as well as throughout the entire Nikon Group. Nikon is fully prepared to adapt and utilise new technologies in our products.

Our in-house training and technical certification system now offers a course on lead-free soldering, assisting employees in mastering the new technology. Over 100 instructors have been trained in Japan and overseas, who, in turn, are training workers involved in the actual soldering process.

The majority of the lead-free solder used at Nikon is the tin silver-copper alloy that has been most widely used in the industry, but with our wide range of products we are also required to use low-temperature tin-silver-indium-bismuth solder.



Lead-free flow furnace at Yokohama Plant



Lead-free PCB for advanced IC stepper

## Examples of Lead-Free Solder Introduction and Implementation

Plans to utilise lead-free solder are being implemented under the Environmental Action Plan (page 10), and in fiscal 2005, 100% lead-free solder was used for new consumer products including the D2x and D50 digital SLR cameras and the Monarch Gold Laser 1200 portable laser distance meter, among others. Boards for existing products are also gradually being converted to the use of lead-free solder.

In regards to industrial products, we are promoting the use of lead-free solder in the design and manufacture of diverse boards, and have expanded its usage to products such as microscopes and surveying instruments.

We expect to use lead-free solder in all consumer products and expand the range of industrial products using lead-free solder to include steppers and many others.

## Eliminating Hexavalent Chrome from Surface Treatment

Hexavalent chrome compounds are extremely hazardous substances, but have been used extensively for many years in metal surface treatment. Nikon has been developing alternative technologies, while reviewing chemicals and processes used for chromate treatment and chrome plating. In December 2004, at the Yokohama Plant hexavalent chrome was totally eliminated from the line and replaced by a safer alternative.

Surface treatment covers a variety of different types, workplaces and components, and therefore poses a wide range of problems. As Nikon continues to stress the elimination of hexavalent chrome, we are also involved in stringent checks of other substances used in the coating, plating and chemical processes of surface treatment, such as lead and cadmium, and are working to eliminate heavy metals entirely.



Left: Conventional chrome-plated product (using hexavalent chrome)  
Right: New chrome-plated product (free from hexavalent chrome)

## Reductions in Use of Other Hazardous Substances

Nikon is taking steps to reduce the amounts of hexavalent chrome, lead, cadmium, mercury, PBB, PBDE and PVC in our products, as far as is technically possible.

We are also developing new substances to replace hexavalent chrome in surface treatment, investigating technologies to replace PVC in cable and wire sheathing and camera cases, and investigating the potential of alternative materials for a wide range of metals, plastics and electronic parts. Our goal is to develop products which use none of these hazardous substances.