11. ECO-DESIGN AND ECO-EFFICIENCY IN EVERLIGHT CHEMICAL

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ABSTRACT

EverLight Chemical Industrial is engaged in the manufacture of high-tech chemicals. We realize that the earth has limited resources and appreciate the importance of sustainable development. As a responsible global corporate citizen, EverLight supports worldwide environmental movements. To fulfill our commitment to environmental protection, Everlight became the first chemical company in Taiwan to obtain ISO 14001 certification. The company has made clear strides in reducing the volume of pollution produced, and has also greatly improved its manufacturing and pollution prevention measures. EverLight's efforts to move toward cleaner production cover the whole product life cycle. Concrete successes have been enjoyed by using spray drying, to reduce the volume of wastewater, and by using hydrogenation to replace the original use of iron powders. In order to match the direction of environmentalism, EverLight Chemical has not only implemented active research and development into pollution prevention technology, but has set the raising of eco-efficiency and the expansion of resource productivity as its new management foci for the beginning of the next century. In the future, the company will work hard not only to reduce the amount of pollution generated by our operations, but also to implement a life cycle assessment of products and plan ways to reduce the load on the environment. Through these efforts, we hope to achieve our goals of "Design-for-the-Environment."

INTRODUCTION

The EverLight Chemical Industrial Corporation was established in 1972 as a producer of dyestuffs. After many years of hard work, its dyes have become extremely competitive, with annual sales of 20,000 metric tons in 1988. The company has become one of the top 10 dyestuffs manufacturers globally. Apart from dyes, the firm is also actively expanding into UV absorbers, bulk pharmaceuticals, electronic chemicals, and new materials such as Sol-gel. The company has positioned itself as a "high technology chemical producer" for the 21st century.

In order to match the direction of environmentalism, EverLight Chemical Industrial has not only actively implemented research and development into pollution prevention technology, but has set eco-efficiency and expanding resource efficiency as its new management foci. In the future, the company will not only work hard to reduce the

amount of pollution generated, but will also set criteria for new product design and plan ways to reduce the load on the environment. Through these efforts, the company seeks to achieve its goals of "Design-for-the-Environment." The company's major achievements in safety, health, and environmental management over the last five years are outlined in Table 1.

Table 1. EverLight's Environmental Achievements, 1995–2000

Date	Activity	Sponsor
1996.10	Obtaining ISO-14001 Certification	DNV
1997.04	Awards for Excellence in Energy Conservation	MOEA
1998.03	Awards for Excellence in Pollution Control	EPA
1998.07	Voluntary Protection Program Accreditation	CoLA
1999.01	Application of Environmental Cost Accounting	Everlight
1999.01	Life Cycle Inventory in Dye manufacture	Everlight
1999.07	Corporate Environmental Report	BCSD, Taiwan
2000.01	Establishment of OHSAS 18001	IDB,CTCI

Abbreviations:
DNV – Det Norske Veritas.
MOEA – Ministry of Economic Affairs.
EPA – Environmental Protection Agency.
CoLA – Council of Labor Affairs.
BCSD – Business Council of Sustainable Development in Taiwan.
IDB – Industrial Development Bureau, MoEA.
CTCI – China Technical Consultants Inc.

ECO-DESIGN

New products are under environmental scrutiny from the first stage of the development process. In order to demonstrate compatibility with the environment, new products must undergo an environmental impact assessment during the planning stage. At each stage in the incubation pipeline for new products, environmental aspects must be evaluated by specialists, with results approved by the steering committee. After passing through the stages of verification and validation, the final designs must be reviewed according to their final environmental impact inventory data and their eco-efficiency is calculated. This environmental inventory database is a great help to the researchers in the effort to design environmentally sound products. The step-by-step, stringent evaluation process ensures that new products have the lowest environmental impact possible. Figure 1 depicts the new product design process and Table 1 shows an example of the Environmental Inventory Worksheet used at EverLight.

ECO-EFFICIENCY

Eco-efficiency is an indicator used around the world to relate company environmental performance to value creation. Eco-efficiency "is reached by the delivery

of competitively priced goods and services that satisfy human needs and bring quality of life while progressively reducing ecological impacts and resource intensity throughout the life cycle to a level at least in line with the earth's estimated carrying capacity." Application of eco-efficiency principles supports the monitoring and reporting of environmental and economic progress toward sustainability and facilitates decision-making by management and external stakeholders.

The creativity and innovation of the business community are the most important elements for improving eco-efficiency. Therefore, the following categories explain the progress that EverLight Chemical Industrial has made in reducing its negative environmental impact.

Air Pollution Minimization

During the process of manufacturing dyestuffs, particles and acid aerosols are created. To comply with the Air Pollution Control Act and industrial hygiene regulations, the company invested in facilities to effectively reduce air mists along the product line including: scrubbers, venturi towers, cyclones, packing towers, and baghouses. The interception of particles and aerosols is now over 99 percent. The air quality in the workplace fully complies with occupational safety and health standards and with environmental regulations.

Wastewater Treatment

Wastewater treatment is the most significant concern in the dye manufacturing industry. Due to various characteristics of dye synthesis, the volume and quality of the wastewater stream change frequently. Pollution prevention during processing is always our major objective as part of the continuing improvement of our environmental management system. Important recent projects included the recycling of waste acid into ferrous sulfate and the replacing of iron-powder reduction with hydrogenation. The former has effectively lowered the cost of coagulation, while the latter has significantly reduced the amount of iron sludge generated by our facility.

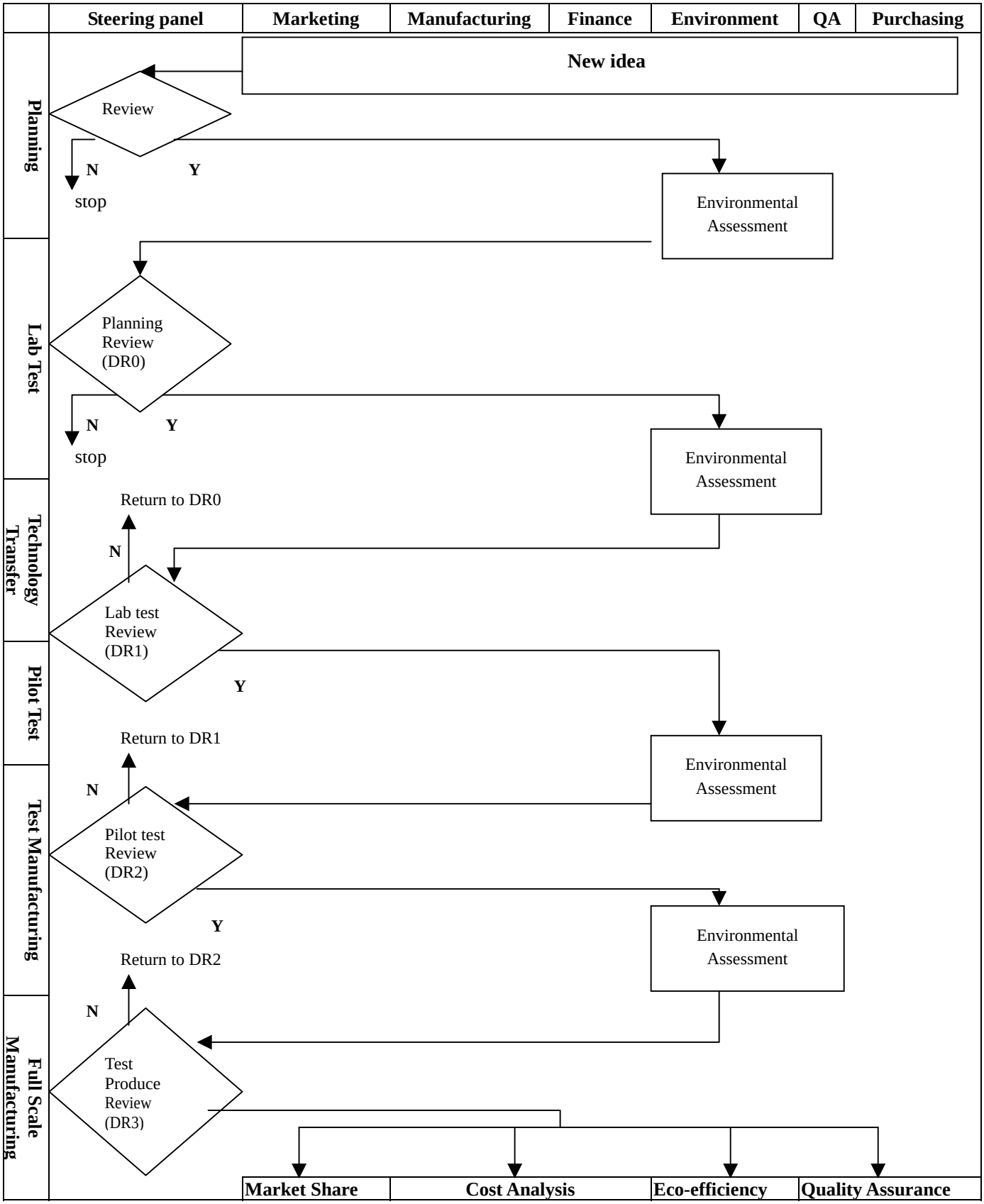
Significant progress has also been made in the treatment of our final effluent. Technologies and facilities to remove color and turbidity have already progressed to the tertiary treatment stage. The use of the advanced oxidation process is one successful example. Ozonation is a state-of- the-art technique, which effectively converts pure oxygen into ozone. In order to overcome the solubility problem of ozone, a venturi injector is used to completely coalesce the high velocity waste stream and ozone gas. The air-liquid two-phase stream is introduced into a pressurized vessel to oxidize the recalcitrant organic compounds in sufficient retention time. The effluent can be either recycled into an aeration tank to improve biological treatment efficiency, or can be directed into a neutralization buffer vessel for discharge. Ozonation promises to reduce the refractory COD and color in a highly efficient manner with less sludge. Through the combined application of pollution prevention and treatment technologies, our performance has improved greatly in recent years. Some environmental measures listed in Figures 2, 3, and 4. The operation of our wastewater treatment unit is depicted in Figure 5.

Solid Waste Minimization

Within the dyestuff manufacturing process, the solid waste problem has received a high level of attention. In addition to efforts to recycle and reuse wastes, costly incineration technologies have also been adopted to further reduce the volume of the waste sent to landfills. The first small-scale fluidized bed incinerator in Taiwan, designed by the Industrial Technology Research Institute, was built in 1995 in EverLight Factory 3 to incinerate waste solvents. Since 1999, all three EverLight factories have built their own incinerators to reduce the volume of industrial waste sent to landfill. The total volume of solid waste has been dramatically reduced to three percent of the original amount. A newly designed rotary kiln incinerator for sludge produced from wastewater treatment will soon be operational. As a result, additional reductions in waste volume are expected.

CONCLUSION

Over the past twenty-eight years of conducting business, EverLight Industrial Corporation has not only continually improved the technical standard and quality of its products, but has also unceasingly sought perfection in its environmental technology. As we march into the next century, EverLight Chemical will clearly unite its principles of economically, socially, safe, and environmentally balanced development to manage its five major areas of business. Creativity and innovation, ever higher eco-efficiency, and eco-design and research have already become key success factors in the culture and consciousness of EverLight. We believe that continuing to improve in this way and always striving to be better will surely allow us to achieve our goals of green production and sustainable development.


Steering panel
Marketing
Manufacturing
Finance
Environment
QA
Purchasing
Planning
Lab Test
Technology Transfer
Pilot Test
Test Manufacturing
Full Scale Manufacturing
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Environmental Assessment
Planning Review (DR0)
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Lab test Review (DR1)
Y
Environmental Assessment
Return to DR1
N
Pilot test Review (DR2)
Y
Environmental Assessment
Return to DR2
N
Test Produce Review (DR3)
Market Share
Cost Analysis
Eco-efficiency
Quality Assurance

Table 2. Environmental Impact Inventory Worksheet

Product Name:
Investigator: Date： Duration： /yr /mon /date TO /yr /mon /date
Phone:

Factory	Raw materials		Products		Energy		Pollution discharged					
							Air emissions		Wastewater		Industrial waste	
	Items	Consumed annually	Items	Produced annually	Items	Consumed annually	Items	ppm	Items	ppm	Items	kg
	Tap water						CO		COD			
	HCl						CO_2		BOD			
	NaOH						SO_2		SS			
							NOx		Phenols			
							HCl					
							Cl_2					

Figure 2. Electricity Use per ton of Product, 1995-1999

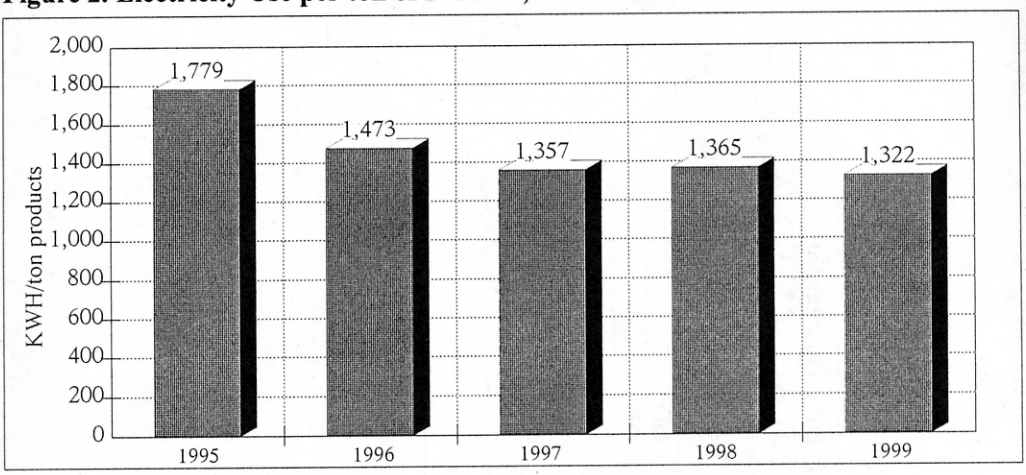

Figure 3. Well Water Use and Volume of Wastewater Discharged, 1995-1999

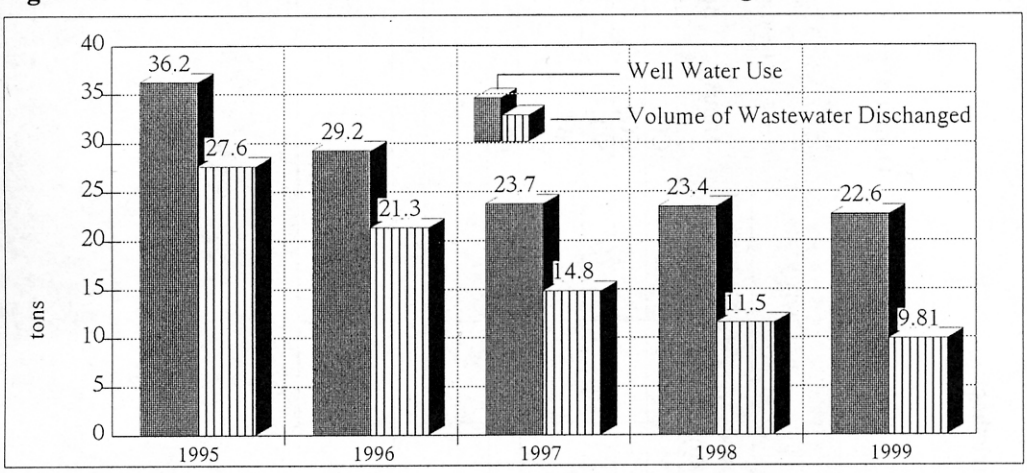

Figure 4. COD Generated per ton of Product, 1995-1999

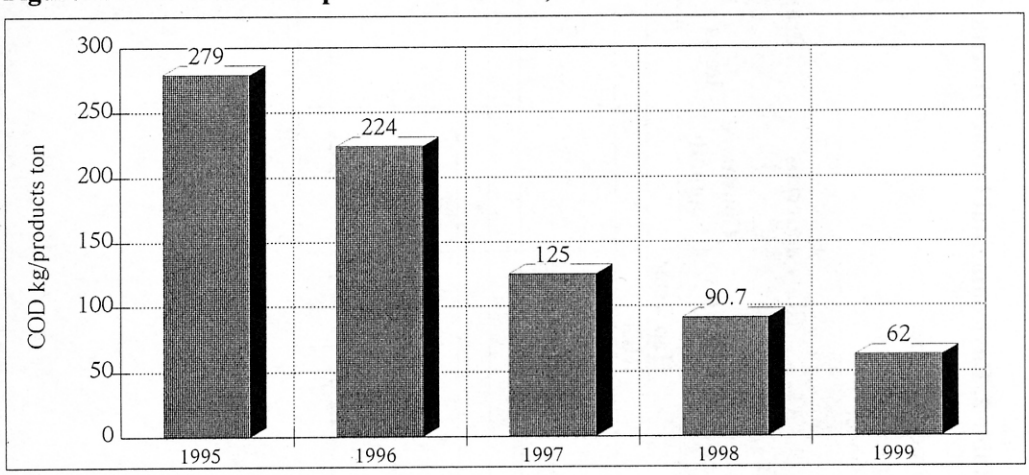

Figure 5. Flow Diagram of EverLight Wastewater Treatment System