

**2001 GREEN PERMIT ANNUAL REPORT
LSI LOGIC CORPORATION
GRESHAM, OREGON**

EXECUTIVE SUMMARY

LSI Logic received our Green Permit on December 7, 2000. In accordance with the requirements of the Green Permit, LSI Logic continued to improve our environmental performance and achieve results that are beyond compliance. The report summarizes the environmental improvement activities, environmental compliance, and stakeholder activities. LSI Logic continued to improve our environmental performance and achieve results that are beyond compliance. Our accomplishments and awards, including the following highlights, exemplify our commitment:

- In 2001, the Environmental Management System (EMS) was recommended for continued ISO 14001 registration. LSI Logic is working in cooperation with the Oregon Department of Environmental Quality (DEQ) and the Environmental Protection Agency (EPA) to develop a site-specific rule for an equivalency determination for Resource Conservation and Recovery Act (RCRA) Subpart BB and CC.
- At LSI Logic, every department is responsible for improvements in environmental performance. Each employee, from entry-level maintenance to upper-level executives, is evaluated on their contribution to this goal. This system provides a strong incentive for all employees to continually strive for environmental innovation.
- We initiated design of wastewater reclaim system that will be able to recover and reuse 80% of the process wastewater. The construction of this project is estimated to be complete in 2003 and will ultimately result in a 600,000 gallon per day reduction in water consumption and wastewater discharge.

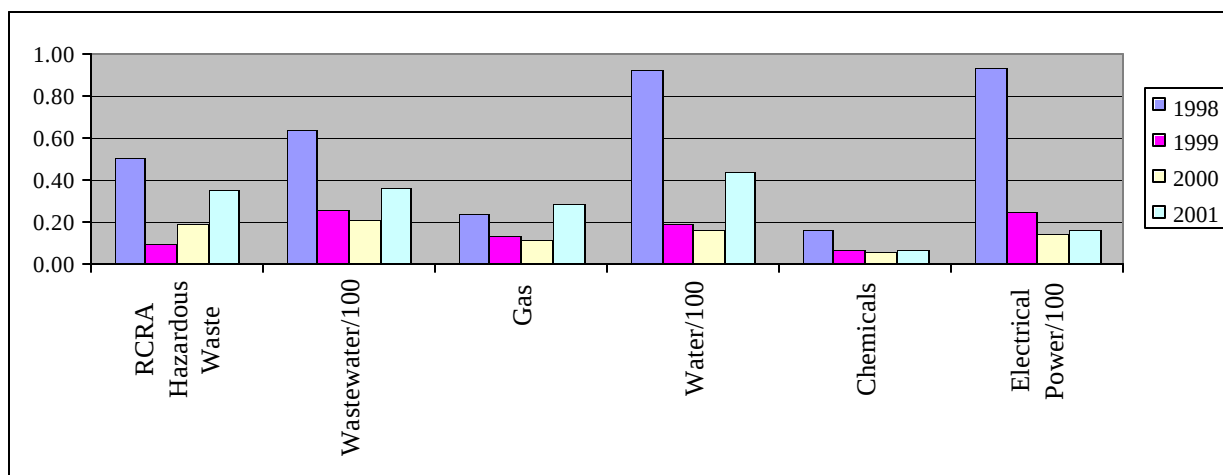
In 2001, fifteen environmental improvement projects were implemented at the LSI Logic Gresham campus. The following data represents the 2001 resource reductions and pollution prevention as a result of our environmental improvement activities:

• Gallons of Chemical Reduction	6,800
• Gallons of Spent Chemicals Recycled	65,000
• Gallons of Water Saved	9,300,000
• Kw of Energy Saved	112,000
• Pounds of Solid Waste Reduced	29,000
• Miles avoided	230,000

Since the first full year of manufacturing at LSI Logic was 1998, this year is used as the baseline for measuring environmental impacts at the facility. The bar chart shows pollution generation and natural resource use between 1998 and 2001. The comparison uses pollution and usage

numbers that are normalized for production, as production levels within the electronics industry fluctuate greatly from year to year.

Through continuous source reduction, recycling, process optimization and product yield improvements, LSI Logic strives to minimize the environmental impacts of our semiconductor wafer production. Since the fab was not operating at full capacity in 2001, the normalized environmental impact was greater than in 2000. However the impacts were still less than the baseline 1998 level in all categories except gas usage.



The 2001 Annual Hazardous Waste Generator Report and the 2001 Air Contaminant Discharge Permit Annual Report are included as attachments to the 2001 Green Permit Report.

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1.0 PERFORMANCE ACHEIVEMENTS

In 2001, LSI Logic continued to improve our environmental performance and achieve results that are beyond compliance. Our accomplishments and status of our Environmental Management System, and media programs are described below.

1.1 Environmental Management System

LSI Logic received ISO 14001 registration in June 2000. The registration assessment audit was conducted in August 2001 by Underwriter's Laboratory. We received a recommendation for continued registration with no major non-conformances.

The objectives of our Environmental Management System (EMS) are to continuously ensure regulatory compliance and to minimize our impact on the environment. Significant environmental aspects of the Gresham activities, products and services were identified as chemical, water and energy consumption, solid waste generation and transportation. .

The Gresham campus established a goal to *Improve Environmental Performance*. Each department has a target for completing one Environmental Improvement Project evaluation annually. Environmental Project Evaluation Forms are used to track projects and to evaluate environmental impacts, cost effectiveness, technical feasibility and effects on product quality, health & safety and regulatory compliance. The project focus areas, which were determined from our significant environmental aspects, are:

- Chemical Reduction/Pollution Prevention
- Water Conservation
- Energy Conservation
- Solid Waste Reduction
- Transportation and Trip Reduction

Fifteen environmental improvement projects were completed in 2001. A summary of these projects is provided in this report.

1.2 Toxic and Hazardous Materials Minimization Program

LSI Logic continued to focus efforts on minimizing chemical consumption and hazardous waste generation. Environmental improvement activities conducted in 2001 resulted in a chemical reduction of 6,800 gallons. The projects implemented to achieve this reduction are described below.

1.1.2 RCRA Subpart BB and CC

The Subpart BB and CC of the RCRA regulations are intended to ensure proper monitoring and control of air discharges of volatile organic compounds from hazardous waste tanks (and containers), and other equipment associated with hazardous waste management. As a large quantity generator (LQG), LSI Logic is subject to these rules. However, extensive air monitoring and controls are in place to meet the conditions of the Air Contaminant Discharge Permit (ACDP), as well as inspection and maintenance programs proscribed by the EMS. The additional monitoring required by Subpart BB and CC would not provide any measurable environmental benefit, given the control systems already in place. LSI Logic provided a detailed assessment of how current air emissions controls meet, or exceed, the intent of Subpart BB and CC rules to DEQ and EPA. EPA is currently drafting a site specific rule, which would set a precedent for the semiconductor industry.

1.1.3 Spent Chemical Recycling

In the previous SIP reports, we described how the Gresham fab was designed to facilitate chemical recycling and reuse. Separate piping and tank collection systems were installed for our spent isopropyl alcohol (IPA), sulfuric acid and phosphoric acid. In 2001, we qualified local companies to purchase the spent chemicals that had been previously sent to southern California for reuse, and in the case of the sulfuric acid, to Shreveport, Louisiana for reprocessing. An alum manufacturer in the Greater Portland area qualified the spent acid to use in their process, and a local paint manufacturer is now purchasing the spent IPA. This reduces risk and emissions associated with long distance transportation.

In 2001, we recycled approximately 65,000 gallons of spent chemicals. Recycling resulted in resource conservation, reduction of hazardous waste generation, and cost savings from deferred treatment and disposal expenses.

1.1.4 Process Changes

1.1.4.1 Reduction in Process Qualification

To improve cycle time and conserve resources, process qualifications were significantly reduced in 2001. Instead of using two lots of wafers for reliability data, the process was consolidated into one lot. This resulted in an estimated reduction in chemical consumption by at least 2,200 gallons per year.

1.1.4.2 Conversion from Wet to Dry Processing

In 2001, LSI Logic converted the G11 technology to a dry process for etch cleaning, and converted the G12 technology to dry processing in 2002. Dry processing uses ozone to replace hydrofluoric acid and sulfuric acid, and eliminates the DI water required for rinsing. Implementation of this process change resulted in an estimated reduction of HF consumption of 2,000 gallons. The water savings, which are more significant, are described below.

1.1.5 Protocol Reduction

Controlling cleanliness in the fab is essential to maintaining high product yield and preventing defects. LSI Logic's fab was constructed using Standard Mechanical InterFace (SMIF) technology. This technology is based on the premise that it is easier to control airflow in smaller volumes of space within the cleanroom than in the volume of the entire cleanroom itself. It operates on the philosophy of localized clean zones, whereby SMIF equipment is used for contamination control only in the area immediately surrounding the wafers being processed. SMIF fabs essentially comprise of mini-cleanrooms through which wafers pass without exposure to the ambient production facility air. The success of the SMIF design allowed LSI Logic to relax protocol requirements for construction, cleaning and operation.

Reduction of cleaning requirements in 2001, translated to a decrease in chemical consumed in the cleaning of cleanroom tools, equipment and consumables. The estimated reduction in 9% IPA is 2,600 gallons per year.

1.1.6 Mercury Vapor Lamp Reduction

Minimization and ultimate elimination of mercury sources are under critical scrutiny by the public and the regulatory agencies. The DNS 200W track systems use a mercury arc lamp in the edge exposure unit. Each unit contained two mercury lamps. In April 2001, a method was implemented that eliminated the duality of the lamps. This adjustment will reduce the annual volume of mercury vapor lamps by 25 pounds.

1.3 Water Conservation, Reuse and Wastewater Discharge

1.3.1 Conversion to Dry Processing

Implementation of a dry clean for the G11 and G12 technologies, as described above, resulted in an approximate water savings of 8,500,000 gallons per year.

1.3.2 Protocol Reduction

As described above, the protocol reduction indirectly saved 25,400 gallons of water per year due to the reduction in garment washing and cleaning.

1.3.3 Wastewater Reclaim System Update

The average process wastewater (PWW) discharge from the fab operations was approximately 425,000 gallons per day (gpd) in 2001. At full capacity we estimate the average discharge will be 600,000 to 800,000 gpd. To reduce the overall water consumption and wastewater discharge, in 2001 LSI Logic initiated the design of a wastewater reclaim system that would allow us to reuse 80-85 percent of our wastewater in the front of the ultra-pure water (UPW) system.

Pilot testing of the reclaim technologies completed in 2000 verified the technical feasibility of the reclaim system. The wastewater reclaim system will utilize a fluidized bed bioreactor as the primary technology to remove the contaminants of concern and achieve the goal to return the PWW effluent to incoming water quality. Construction of this system has been postponed until late 2002. The anticipated completion date is December 2003.

1.3.4 Landscaping Water Use

When LSI Logic designed and planted the landscaping on the site in 1997, an effort was made to design for the environment. Many indigenous plants were selected that are naturally accustomed to the climate and were therefore good choices for water and waste efficient landscaping. The area planted around the buildings as grassy lawn was minimized.

To maintain the health of the lawn, a sprinkler system was installed to use the available perched aquifer water as the source. The irrigation system was initially designed to operate only based on time. Proper watering is important to maintain an attractive, healthy lawn; however since water is a limited resource, we have teamed with our landscaping company to install a more efficient irrigation system.

In 2001, LSI Logic installed a sophisticated irrigation system that uses temperature and humidity monitors to evaluate the lawn water requirements. The proper volume of water applied to a lawn depends upon the variety, climate conditions, soil absorption rate and the heat intensity. The implementation of this system will make a significant contribution to water conservation and save up to 27,800 gallons per week during watering season, or an estimated 800,000 gallons per year.

1.4 Air Quality

LSI Logic is regulated by the DEQ as a synthetic minor source of air pollution. The nature of the chemicals used in the semiconductor manufacturing operations generates criteria air pollutants and hazardous air pollutants (HAPs). Wet scrubbers control chemical vapors from corrosive liquids and gases. Volatile organic compounds (VOCs) from solvent workstations are abated by a concentrator/thermal oxidizer. Point of Use (POU) abatement devices are also used to control hazardous gases and destroy global warming gases. Using these treatment systems, air pollution generated from our operations was decreased by over 90 %.

1.5 Transportation

LSI Logic continued to participate in the DEQ Clean Air Action Day campaign and provided information to employees on the importance of using alternative transportation. Preferential parking is provided for car-poolers and free Tri-Met passes are offered to all employees to encourage the use of alternative transportation. Last year, LSI Logic Gresham expanded its employee shuttle service between the site and the Gresham Transit Center and also to Portland

International Airport. This service enabled employees who take the bus or MAX to have easy transportation to and from the Gresham facility and the airport.

In 2001, LSI Logic continued supporting the Alternative Transportation Involvement Program (ATIP), which rewards LSI employees and resident contractors that use alternative transportation during their daily travel to and from Campus.

The employees involved in the program can choose to commute through any of the following forms of alternative transportation: walking, running, bicycling, riding a motorcycle, taking the bus, riding MAX and the LSI Shuttle, or carpooling. Each day the employee records their commuting activity on a Reward Cards and receives a credit. The credits are redeemable for prizes and gift certificates at local merchants.

In 2001, over 200 employees and contractors redeemed ATIP credits for prizes. The average commute length was approximately 27 miles. The program helped to avoid almost 230,000 trip miles and prevent 1,363 pounds of hydrocarbon emissions, and 11,314 pounds of carbon monoxide, and 854 pounds of nitrous oxides.

1.6 Energy Conservation

Consumption of energy from nonrenewable sources continues to be one of the most significant environmental impacts of LSI Logic's operations. In 2001, LSI Logic not only reduced energy consumption on-site by the projects described below, but also provided employees and contractors over 5,000 compact fluorescent light (CFL) bulb coupons for personal use. Assuming that each CFL coupon was used to replace a 60-watt bulb with a CFL, the annual energy savings would be 207,500,000 kilowatt-hours per year (kw-hr/yr).

1.6.1 Climate Wise Action Plan

In 1999, LSI Logic signed a Climate Wise partnership agreement with the Environmental Protection Agency. The Climate Wise Partnership is a joint effort between the EPA and the Department of Energy to help industry to pursue energy conservation and resource reductions. In 2001, we continued to evaluate projects for potential implementation in the four significant aspect groups: energy conservation, pollution prevention, water conservation, and chemical reduction.

1.6.2 Protocol Reduction

The elimination of the air showers in the fab, a result of the protocol reduction, will save an estimated 64,000 w-hr/yr.

1.6.3 Cleanroom Facilities Optimization

The heating, ventilation, and air conditioning (HVAC) system in the fab controls not only the temperature and humidity of the building, but also is a significant factor in contamination control. The cleanroom recirculation fans are used to provide a uniform airflow of ultra-clean air

over the manufacturing area. Large amounts of energy are used to recirculated the cleanroom air and removed the fan heat. To optimize the energy consumption of the fab, in 2001 LSI Logic powered down two ballroom supply fans, which resulted in an estimated energy savings of 48,000 kW-hr/yr.

The following table summarizes LSI's energy consumption:

Energy Consumption					
	1997	1998	1999	2000	2001
Electricity (kilowatt hours)	145,181	75,516,730	82,150,320	103,003,200	111,627,180
Natural Gas (mmcf)	1.05	56.32	53.09	169	214

1.7 Solid Waste Reduction and Recycling

In 2001, LSI Logic recycled over 207 tons of solid waste. This figure represents the consumable office products recycled, and not the chemicals or byproducts that were also reused.

1.7.1 Shoe Cover Recycling

To maintain cleanliness in the site office building and non-manufacturing areas, all employees, contractors and visitors are required to wear shoe covers or building shoes. In 2001, LSI Logic switched from disposable shoe covers to reusable ones. Previously, over 500,000 pairs of disposable shoe covers were disposed of as solid waste. Changing to reusable shoe covers reduce our solid waste by 16,000 pounds annually.

1.7.2 Core Training Revision

Core Training is a five week program for newly hired Manufacturing Specialists at LSI Logic. Core Training is conducted at Mount Hood Community College in the Microelectronics Training Center. Previously Core training materials were published for each new student. In 2001, the training material was consolidated in electronic format and printed material is reused. This revision resulted in a resource conservation and solid waste reduction of approximately 4,000 pounds per year.

1.7.3 Elimination of Disposable Cups

To reduce costs and conserve resources, LSI Logic eliminated paper disposable cups in 2001. LSI Logic previously consumed approximately 1,200 cups per month. Assuming each cup weighs approximately 10 ounces, this reducing solid waste disposal by 9,000 pounds.

1.7.4 Computer Donation to STRUT

Through the Students Recycling Used Technology (STRUT) program, LSI Logic donated used PCs and components to Gresham area schools. In 2001, we donated 59 computer systems, 8 printers, 78 monitors, and two fax machines to the STRUT program. As local high school

students refurbish the systems, they learn diagnostic and repair skills. Repaired systems are then donated to local schools.

2.0 EMS DEFICIENCIES

LSI Logic utilizes an Access computer database to track compliance issues. The database, referred to as the Correction Action Defect Event Tracking (CADET), according to Microsoft is the largest Access database in the world! CADET ensures closed loop corrective action. Defects are logged immediately after the occurrence. Root cause is required to be identified, as well as contributing factors, short-term corrective actions, and long term corrective actions. The actual environmental impact, regulatory actions, and any procedure modifications and training requirements are also recorded.

In 2001, we identified 41 internal defects. Defects are designated by program area, including EMS, air, water, and hazardous materials. Ten accidental releases occurred on-site in 2001. All of the releases were either contained in secondary containment and cleaned up, or abated by the air pollution control equipment. No injuries or detrimental environmental pollution occurred from these internal releases. The incidents were all recorded as CADET events and closed out after procedures were modified and training conducted as necessary. None of the accidental releases were reportable under federal or state rules.

In 2001, LSI Logic received two notices of violation from the City of Gresham. One was due to low pH wastewater discharged to the City of Gresham's Wastewater treatment plant, caused by an accidental operator error. The other violation was due to a self-monitoring report submitted one day late. Corrective actions were completed for both items to prevent reoccurrence.

Other CADET events included such issues as proper procedures for chemical approval were not followed, wastewater treatment system monitoring equipment malfunctions, improper labeling of equipment and chemical containers, and training issues.

3.0 ENVIRONMENTAL COMPLIANCE SUMMARY

LSI Logic is committed to 100% compliance with federal, state and local environmental regulations. In 2001, Gresham completed 214 required environmental permits, reports and documents. Internal environmental self-audits are regularly performed to detect and correct regulatory and internal environmental policy discrepancies.

The following environmental permits have been issued to the Gresham campus:

Agency	Permit Type	Number	Effective Date
DEQ	Air Contaminant Discharge	26-0027	7/01/01
City of Gresham	Industrial Wastewater Discharge	332	1/31/02
DEQ	Hazardous Waste Generator	ORQ000004382	9/27/96
DEQ	Green Permit	GP-01	12/8/00

3.1 Air Quality

The 2000 Annual Report was submitted to the DEQ on with our Annual Green Permit Report on April 1, 2001. We satisfied all of the permit conditions, and were significantly below all of our Plant Site Emission Limits. An application for renewal of the Air Contaminant Discharge Permit was submitted to DEQ in 2001. A draft permit has been received. The permit will be finalized after the 30-day public comment period.

3.2 Wastewater

LSI Logic's Industrial Wastewater Permit was renewed in 2001. The on-site treatment systems include fluoride, ammonia, and acid waste neutralization. Wastewater effluents are sampled weekly and self-monitoring reports were submitted monthly to the City of Gresham. In 2001, LSI Logic received two notices of violation from the City of Gresham. One was due to low pH wastewater discharged to the City of Gresham's Wastewater treatment plant, caused by an accidental operator error. The other violation was due to a self-monitoring report submitted one day late. Corrective actions were completed for both items to prevent reoccurrence.

3.3 Hazardous Waste

In 2001, LSI Logic was a large quantity generator of hazardous waste. We submitted our Annual Hazardous Waste Report to the DEQ on with our Annual Green Permit Report on April 1, 2001. The largest RCRA hazardous waste streams were isopropyl alcohol (IPA), which is used in the wafer cleaning process and ammonium sulfate, which is a byproduct of the ammonia treatment system.

RCRA Hazardous Waste Stream	Total Volume (tons)
Isopropyl Alcohol	759
Ammonium Sulfate/Sulfuric Acid	287
Waste Photoresist/EBR	46.8
Solvent Containing Solids	3.83
Arsenic Debris	1.42
EKC 265 Wipes	1.33
Empty Nowpacs	0.07
Lab Packs	0.32
Ammonia Determination Vials	0.05
Total	1099

In 2001, Gresham generated 1099 tons of RCRA hazardous waste. This figure represents a 64% increase over calendar year 2000. The increased generation of two waste streams, isopropyl alcohol (IPA) and ammonium sulfate account for most of the additional waste. Overall, our hazardous waste generation has been reduced by 63% from the 1998 baseline.

As we reported in the 1999 SIP report, the increase in hazardous waste generation is attributed to the three new wet benches which were purchased for use by manufacturing in 2000. These tools utilize a continuous flow through design, which generates a tremendous amount of IPA contaminated DI water waste. Although the water content of this waste stream is greater than 95%, the flash point is still less than 140 degrees F. The waste generated by these new wet benches nearly doubles the previous generation rate.

3.4 Stormwater

Engineering controls and best management practices have been integrated to create an effective storm water management program at LSI Logic. Our goal is to protect water quality in Fairview Creek, and ultimately the Columbia Slough. In 2000, DEQ conducted a technical assistance site evaluation, and determined that LSI Logic met the criteria for “no exposure” to industrial activity. Subsequently, DEQ terminated our 1200-Z stormwater permit and did not issue a 1200-COLS permit. In accordance with our Green Permit requirement, we continue to implement Best Management Practices (BMPs), collect biannual samples of the stormwater runoff for laboratory analyses, and utilize our EMS to ensure that the stormwater runoff is protected.

4.0 STAKEHOLDER INVOLVEMENT

4.1 Salish Ponds Adoption

LSI Logic continued our partnership with SOLV, the City of Fairview, the Fairview Creek Watershed Conservation Group, and Reynolds High School for the "adoption" of Salish Ponds for restoration. Salish Ponds are a part of a 70-acre park that is home to cutthroat trout, red tailed hawks, crawdads, and other fish and wildlife. In 2001, LSI Logic volunteers helped to plant native species and remove litter and trash to enhance the wetland and streamside areas.

4.2 Green Team

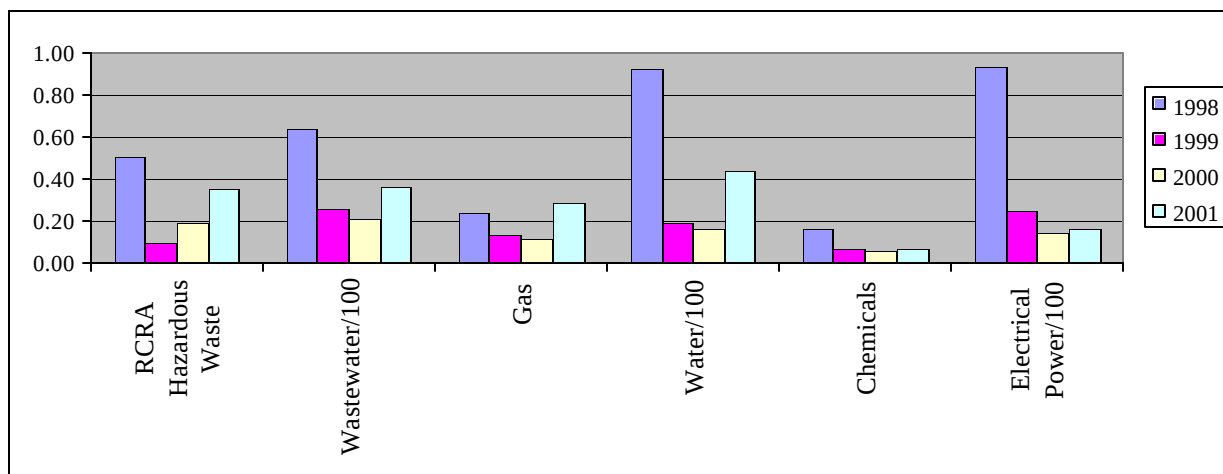
Currently the Green Team has more than 50 members that participate on all shifts. In 2001, the Green Team evaluated waste minimization opportunities such as reusable shoe covers, IPA wipes, old building shoes, and plastic shipping boxes.

4.3 Adopt a Highway

The B-shift Green Team adopted a 2.69-mile stretch of Highway 26. In 2001, they conducted three cleanups along this stretch of highway, collecting everything from fast food wrappers to discarded clothing. The Adopt-a-Highway program, sponsored by the Oregon Department of Transportation, provides an opportunity for the Green Team to help the community and to protect the environment.

5.0 ENVIRONMENTAL PERFORMANCE SUMMARY

In 1998, LSI Logic established metrics to monitor the environmental impacts of our operations. A normalized production unit based on the volume of wafer starts and process complexity was developed to compensate for the site's changing manufacturing rates. Through continuous source reduction, recycling, process optimization and product yield improvements, LSI Logic strives to minimize the environmental impacts of our semiconductor wafer production. Since the fab was not operating at full capacity in 2001, the normalized environmental impact was greater than in 2000. However the impacts were still less than the baseline 1998 level in all categories except gas usage.



2001 Environmental Impact Reductions

The following data represents new resource reductions and pollution prevention achievements as a result of our environmental improvement activities in 2001:

- Gallons of Chemical Reduction 6,800
- Gallons of Spent Chemicals Recycled 65,000
- Gallons of Water Saved 9,300,000
- Kw of Energy Saved 112,000
- Pounds of Solid Waste Reduced 29,000
- Miles avoided 230,000

The objectives and targets of the EMS were not revised in 2001.