



# AgSTAR Digest



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Odors go up in smoke. Installation Crew at first gas flare lighting, North Carolina.

## AgSTAR - The Momentum Builds

Over the past 18 months, six AgSTAR Partners have installed biogas recovery systems and established new profit and environmental centers. This increase in demand is the largest experienced since the mid-seventies. At least 10 more biogas projects are in either planning or construction phases. See the *Showcase and Regional Corner* for some specific farm details. By all indications 1999 will see even larger demand based on AgSTAR program participation, hotline activity, feasibility assessments, and project planning requests. The difference is that today commercial systems are more reliable due to improved design, equipment, technical support, and on-farm innovation. The best innovation we have seen is a complete retro-fit of 2 farrowing houses with heat mats at a 4,000-sow Partner farm. Biogas is used to heat water in a boiler, which is circulated through the farrowing buildings.

These days, producers are selecting biogas technologies for multiple benefits, not solely for energy production. Highest on the environmental benefit list is odor control. All properly designed biogas systems substantially reduce odor. Several dedicated, heated odor control digesters have been built in the last year. Basically an odor control system collects biogas to fuel a boiler that in turn heats the digester. Heating a digester decreases the volume needed to stabilize manure by speeding up the biological (anaerobic) process that destroys odor-producing compounds in the manure. Controlled high temperature decomposition in a digester will also reduce pathogens, a major concern in water quality circles today. Dairy farms using scrape manure collection benefit the most from heated digesters because the digested dairy manure yields a high grade, weed and pathogen-free fiber that has commercial value in the potting soil industry; digested dairy manure can be sold for \$4-8/cubic yard.

***AgSTAR has helped 6 Partner Farms establish farm profit and environmental centers with the implementation of biogas technology.***

(continued on page 2)

# AgSTAR – The Momentum Builds (continued)

Other AgSTAR Program highlights include:

- ☆ Publication of National Interim Standards for Biogas Systems by USDA's Natural Resource Conservation Service (NRCS). The United States is now one of a few countries to have such standards. Interim Practice Standards on Covered Lagoons, Plug Flow and Complete Mix Digesters can be found through the World Wide Web at the following address: <http://www.ftw.nrcs.usda.gov>.
- ☆ An improved Memorandum of Understanding (MOU) for Partners and Allies. The revised MOU is a simple one-page voluntary agreement. In addition to emphasizing methane recovery, the revised MOU recognizes the importance of odor control and containment as a common environmental AgSTAR goal because of increasing odor concerns surrounding confined livestock facilities. Manure odor management is discussed in the *Environmental Corner* on page 3.
- ☆ The Environmental Recognition component of the program. Operating Partner Farms are awarded with a 25" x 12" weather resistant, "EPA Partner Farm" sign that can be displayed at farm entrances or along side other farm insignia as at Craven Dairy (shown below). The AgSTAR



AgSTAR Partner, John Craven Jr., under his Partner Farm Sign

Program is also in the process of developing an Environmental Steward certificate (illustrated in the *Showcase Corner*, page 7). This 8½ x 11 certificate is suitable for framing and office display. As future Partner farms go on-line, these symbols of environmental recognition will be awarded together.

- ☆ The release of the AgSTAR Handbook including FarmWare version 2.0. These tools are provided to assist in the project development process based on technology choice, operational ability, financial performance, and environmental performance. See the *Support Corner* for details.

- ☆ Educational and training workshops. The most recent workshop was held at the McKimmon Center in Raleigh, North Carolina. Over 100 individuals - representing producers, the agricultural industry, and state agricultural agencies attended this workshop entitled "Methane Recovery as a Cost Effective Environmental Opportunity for Livestock Producers." This two-day event consisted of a general overview of the AgSTAR Program, methane recovery technologies, anaerobic biology, odor control, water quality benefits, project development, and a field tour of a commercial farm operating a covered lagoon biogas system.



Stacy Gettier leads workshop participants on a tour of an on-farm digester facility.

- ☆ Expanded AgSTAR services to include cooperative or centralized digester assessments. This manure management strategy can provide opportunities for multiple farms. Key factors influencing multiple farm feasibility are herd sizes, manure management method and distance from centralized digester site(s). Typically, digester sites are located near some large energy user or electric utility gateway. Site examples include feed mills, prisons, rendering plants, substations, and other large users of heat and electricity. Successful planning of centralized digesters needs to include assessment of technical, financial, environmental, and organizational elements to insure successful long-term operation. The AgSTAR program has completed two feasibility assessments. See *Regional Corner* for project details.
- ☆ AgSTAR's Charter Farm Program is designed to assist in the development of biogas technologies at commercial livestock farms to demonstrate a variation of appropriate technologies in key livestock producing states. Charter Farms are available to livestock producers and others for site visits on an appointment basis. Operational charter farms already include dairy and swine farms in New York, Pennsylvania, North Carolina, Illinois, Iowa and Oregon. Charter Farms are also in construction or planning phases in Colorado, California, Wisconsin and Minnesota. To make arrangements for a farm visit to "kick the tires" and talk with farm operators, or to apply as a Charter Farm candidate for the 1999 construction season, call the AgSTAR Hotline at 1-800-95AgSTAR (1-800-952-4782).



# AgSTAR Support Corner: AgSTAR Handbook & FarmWare

AgSTAR is pleased to announce completion of the first edition of the AgSTAR Handbook -- a comprehensive "how-to" manual for developing biogas systems at commercial farms throughout the United States. The handbook provides a framework for farms that are considering biogas production and use as a manure management option. Using the handbook, a livestock producer should be able to make a "go" or "no go" business decision based on technology choice, operational ability, and financial performance.



The handbook is organized according to the two stages of project development: feasibility assessment and implementation. The feasibility assessment chapters provide guidance on screening for project opportunities, selecting a gas use option, and conducting site-assessments to identify technically

appropriate and cost-effective biogas recovery options. The implementation chapters detail the steps in putting project

plans to work. Chapters include: selecting a developer; obtaining project financing; complying with permitting requirements; and designing and constructing the system.

The appendices of the handbook provide supporting information including profiles of working digesters throughout the U.S., NRCS and DOE contacts, the NRCS Interim Practice Standards, and a list of industry contacts. In addition, the appendices include installation disks and manuals for the FarmWare and RateVision software programs.

FarmWare is a user-friendly decision support computer program that helps livestock producers determine whether a methane recovery system can be profitably integrated into a farm's existing or planned manure management system. The software analyzes the financial performance of a methane recovery system including the installation costs and benefits from on-farm biogas use. FarmWare's reporting features include a Summary Report that can be presented to potential project financiers, contractors, and developers. RateVision (version 1.0) is a software program designed to analyze electricity rate schedules in relation to farm energy load profiles. RateVision files can be imported into FarmWare allowing for a detailed analysis of rate schedules in the financial evaluation of a methane recovery system.

To order a copy of the AgSTAR Handbook and the latest software programs, please call the AgSTAR Hotline at 1-800-95AgSTAR (1-800-952-4782).



## Environmental Corner: Manure Odors Raising a Stink

Manure-related odors have been attracting a great deal of attention over the past few years, pitting the public against the livestock producers. While the detection of odor from livestock facilities varies from nose to nose, there is considerable concern in some parts of the country that manure-related odors will intensify with the continued trend toward larger confined operations. In addition, many believe that increased complaints regarding livestock odors are inevitable as more people move to the country from cities to suburbs.

Seasonal or chronic odor events from manure management systems are indicative of a biological imbalance within the system. Biological imbalances have many potential causes, ranging from system design and sizing to operational parameters. Regardless of the cause, the resulting biological imbalance leads to only partial digestion of the incoming waste stream. Inhibiting complete anaerobic

digestion and methane production allows intermediate odorous compounds to form and escape into the surrounding air potentially creating an odor. Designing and operating manure management systems to promote methanogenic biological activity can effectively reduce odorous compounds. Methane bacteria degrade most odiferous organic compounds producing methane and carbon dioxide, which are odorless. Promoting anaerobic digestion and methane production reduces odorous compound concentrations. In addition, as a secondary benefit, methane is produced and can then be used as an on-farm energy source.

Numerous studies have shown that digested manure emits fewer odors than undigested manure. Pain et al. (1990) quantified these results showing that up to 92% of the odor associated with pig manure can be reduced by anaerobic digestion. A summary of these results is shown in the table below.

Odor concentration (odor units / m <sup>3</sup> air) following spreading of pig slurries on grassland				
Days in Storage	Farm A		Farm B	
	Undigested	Digested (% Reduction)	Undigested	Digested (% Reduction)
5	611	142 (77%)	1101	223 (80%)
20	219	18 (92%)	177	38 (79%)

**Source:** Pain, B.F., T.H. Misselbrook, and C.R. Clarkson. 1990. Odour and ammonia emissions following the spreading of anaerobically digested pig slurry on grassland. *Biol. Wastes* 34: 259-267.



## ShowCase Corner: AgSTAR Partner Farms

### Craven Farm

In December 1996, Jeff Craven, owner/operator of Craven Farms in Cloverdale, Oregon, completed the installation of a methane recovery system at his 650-cow freestall dairy. The heated plug flow digester is an in-ground concrete structure that measures 140 feet long, 30 feet wide, and 12 feet deep. The digester is sized to treat manure from up to 1,000 milk cows, and is covered by an inflatable and impermeable vinyl/plastic material. Manure from the freestall barns is scraped once a day into a collection tank for mixing. From the tank, the manure is pumped into the digester.

Under the anaerobic conditions within the digester, the manure is broken down to produce biogas and a nutrient-rich effluent. The biogas, which is primarily methane, is collected under the digester cover and pumped to two engine generator sets, which started running on biogas January 1997. The engines produce approximately 60 kW of electrical energy each. All of the power produced is sold directly to the local utility company as a source of *green power* for their generation mix.

To maintain an optimum digester temperature of approximately 100°F, a network of water-heated pipes run within the digester. The water is heated and recirculated into the digester from a heat exchanger system used to cool the engine generator sets. By Summer 1997, a plumbing system

will be installed so that hot water from the engine cooling system can also be supplied to the milking parlor.

Once the manure has exited the digester, the solids (Fibers) are separated from the liquid fraction. Separated solids are sold to a local potting soil company and liquid effluent is stored in a lagoon and land applied.

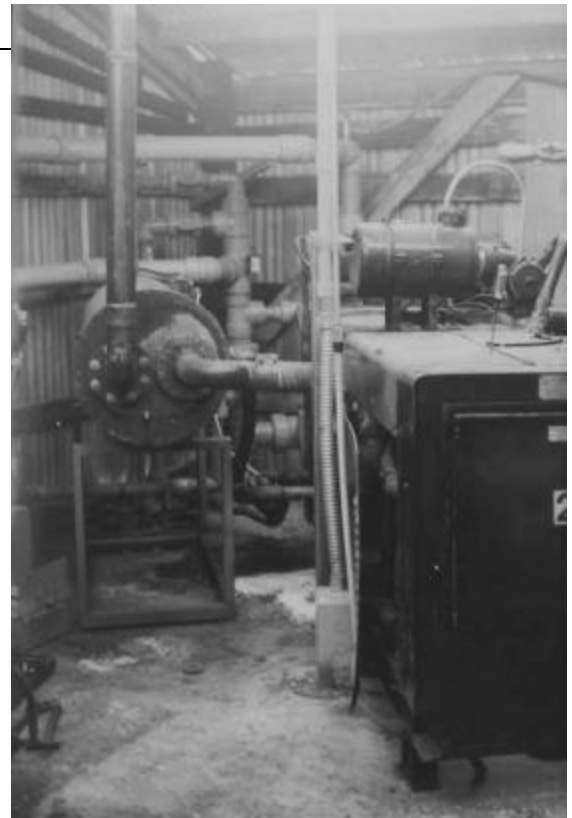
The methane recovery system at Craven Dairy has produced revenues from electricity and fiber sales, while providing the farm with an environmentally sound manure management strategy.



*Craven Farms' Plug Flow Digester.  
The digester is 140 feet long.*



*Separated solids from Craven Farm's Plug Flow Digester*



*Craven Farms' engine room.*

**“Aside from the environmental benefits, the most important aspect of the digester for me is that it is not nearly as complicated as I had anticipated. It doesn't take a chemist to run it. The system is simple and just a basic biological process.”**

***Jeff Craven, Little Nestucca Watershed,  
Cloverdale, OR***

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## Martin Farm

**H**arry and Debbie Martin are raising hogs in southern Virginia at their 600 sow farrow to feeder pig hog facility. They installed a covered anaerobic lagoon in fall 1993. Unfortunately, the cover began to develop problems with gas movement due to rainwater accumulation by the following year. In 1996 the Martins requested technical support from the Tennessee Valley Authority and the AgSTAR Charter Farm Program to address the problems.



*Rainwater accumulation on the previous cover at Martin Farm*

The covered anaerobic lagoon, designed according to NRCS Interim Standard No. 360 measures 124' by 124' by 22' deep. The constant volume primary lagoon receives manure from recycle flush tanks controlled by electronic timers. Buildings are flushed 3-8 times/day with recycled water from a secondary storage lagoon. Methane is produced as the liquid waste stream is treated and is captured by a new modular cover system, which floats on the surface of the primary anaerobic lagoon. The treated effluent from the new covered lagoon overflows into the storage lagoon and is used for recycle water and seasonal fertilization.

Six new modular covers were developed with AgSTAR technical assistance and factory-built by Engineered Textile Products, of Mobile, AL, an AgSTAR Ally. The Martins installed the lagoon covers, built from Seamens XR-5 material, over a three-day period April 1997.

**“The technical support that I have received through the AgSTAR Program has been tremendous. First, AgSTAR and the Tennessee Valley Authority helped me replace the cover on my lagoon. Now, AgSTAR is helping me to maximize the benefits of my biogas recovery system by providing me with innovative options.”**

***Harry Martin, Martin Farm,  
South Boston, VA***

Methane generated in the covered lagoon digester is pumped from under the floating cover with a vacuum pump. The biogas flows from the digester, through a 550-foot underground gas pipeline, into an engine generator. The electrical production system consists of a 6 cylinder Chrysler internal combustion engine coupled to a 25 kW, single-phase induction generator. The unit generates in parallel with the Virginia Power Company. The farm also has a low cost flare to combust biogas during engine down times or periods of excessive gas production. Biogas production varies between 8,000 and 14,000 ft<sup>3</sup> per day, winter versus summer, due to changes in lagoon temperature. Low winter gas production limits engine use.

Providing heat to young piglets may be another benefit of the Martin's methane recovery system. The Martins are considering adapting the farrowing buildings to circulate hot water produced by biogas and the engine system through heat mats. This new technical development, first applied at a Partner Farm in North Carolina, can increase financial returns by reducing heat lamp and propane use for very little cost. Direct use of heat as hot water appears to have a higher value when used in farrowing crates than as previously used in hot air applications.

The Martins are pleased with their methane recovery system. It has helped them realize the benefits of controlling odor and energy production, while being recognized for their environmental stewardship through EPA's AgSTAR Program.



*Installation of new cover at Martin Farm*

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**To arrange a visit to Martin or  
Craven Farms, contact the  
AgSTAR Hotline at  
1-800-95AgSTAR  
(1-800-952-4782)**

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## Other Regional Activities Corner

In addition to the Craven and Martin Farm system, other AgSTAR Partner farms are in either planning, construction, or operational phases of their systems. A few of these farms are highlighted below:

**AA Dairy, Candor, NY.** Bob Aman and his family have over 500 milking cows with scraped freestall manure collection. A plug flow digester was constructed (designed for 1,000 cows) and started-up in fall of 1997. Biogas fuels a boiler to heat the digester and provide heat to the dairy. In early 1998 AA Dairy purchased and rebuilt a used 120 kW engine generator to produce electricity for farm use and sale. The engine will provide 1,200 - 2,000 kWh of electricity per day and is scheduled to go on-line by June 1998.

AA Dairy is separating digested solids for sale as fiber. Separated liquids are stored for irrigation over cropland. About his digester system, Bob Aman said, "We're really excited about this ultimate recycling project."

**Apex Pork, Galesburg, IL.** Glenn and Roger Saline own and operate an 8,600 head finishing farm in west-central Illinois. Nine buildings are equipped with pit recharge manure collection. The storage basin has been prone to seasonal odor events. Therefore, the farm installed a prototype earthen, heated, "mixed" covered lagoon as part of the farm's odor control strategy. After digestion, deodorized effluent will flow to the storage basin prior to land application. The digester will stabilize odor-producing compounds and the additional heat entering the storage lagoon should increase its biological performance over time. The digester is complete and biogas production is expected by early June. Gas is used in a boiler and flare setup.



Example of AgSTAR Environmental Stewardship Certificate

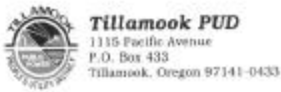
**Boland Farm, Williamsburg, IA.** Gary Boland, a fourth generation farmer, his wife Annette and four children live about a mile from Williamsburg, Iowa, a growing town of 2,500 people. The Bolands operate two separate farm sites, a finishing operation with a deep pit system and a nursery with a pull plug and variable depth storage lagoon.

Since the Bolands built the lagoon two years ago they have observed that the odor is stronger than they would like it to be. Because the Bolands want to do everything possible to be good neighbors, they installed a cover over the 150' by 130' lagoon to capture and flare off methane for odor control. This system does not require heat and is strictly for odor control. Wintertime gas production will be almost zero. The cover was installed early May 1998 and is operational. Total installed cost was about \$15,000.

**Colorado Pork, Prowers, CO.** Gary Swanson, General Manager and part owner of Colorado Pork has begun construction on a new 5,000 sow farrow to wean farm. All buildings will operate on a pull plug manure handling system. The farm's objective is to build an environmentally friendly waste management system that is sustainable both from an energy and nutrients recycling standpoint. A heated complete mix digester for manure treatment is planned as an integral part of the farm's manure management. The decision to build a digester was made after comparing the cost of a 20-day heated mixed digester to the cost of a lined treatment lagoon built to meet NRCS guidelines. The mixed digester was found to be almost the same cost as the lined treatment lagoon, if not less expensive. There also is a return on investment from energy cost savings, estimated at \$67,000/year electric and \$29,000/year propane savings. Farm and digester construction is scheduled for completion in December 1998. Digester start-up should begin Fall 1999, when the farm is three quarters populated.

**Doelman Dairy, Rochester, WA.** Fred Colvin of Hank Doelman Dairy, requested AgSTAR assistance to evaluate the 1,200 cow dairy and surrounding dairies for a centralized digester system. The proposed project is under consideration and may involve up to 6 dairies totaling 3,000 cows. The project consists of 3 phases. The first phase will begin construction on a 1,500 cow digester in Spring 1999. The construction of additional digester modules during phases 2 and 3 is under consideration to accommodate the remaining 1,500 cows.

**Freund Dairy, East Canaan, CT.** Matt and Ben Freund milk 200 cows in a freestall barn with tractor scrape manure collection. The dairy pastures cows 16 hours a day from late spring until early fall and cows are in the barn the rest of the year. A small "drive-in" plug flow digester was completed and started up in Fall 1997. The driving force behind the project was the desire to upgrade the waste management system, better manage the solids in the manure and produce usable byproducts. Biogas is used as a fuel source in a boiler that generates heat for the digester as well as for on-farm use. Excess biogas not used in either application is flared. Freund Dairy plans to use hot water to heat a greenhouse to supply fresh produce for the family's farm store. The farm is considering accepting some manure from neighbors during the pasturing period to maintain constant gas production for fueling a small co-generation unit.



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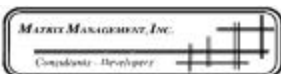
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**NOBLEHURST FARMS, INC.**  
LINWOOD, NY 14486



Matrix Management, Inc.  
Consultants/Developers



**Farmers Cooperative Co.**  
Box 187  
Albia, Iowa 50630

# AgSTAR Welcomes New Participants

AgSTAR welcomes new participants, whose company logos are displayed. All of the program's participants are listed below.

## Partners

AA Dairy \* Apex Pork Facility \* Ballard Hog Farm \* Barham Farms \* Bill Roundy and Sons \* Boland Farms \* Brice Dairy \* Burt Tribble \* Cargill Pork \* Carlwood Farm \* Carroll's Foods, Inc. \* Churchill Co-op \* Circle Four Farms \* Colorado Pork \* Craven Farms \* Crestland Cooperative \* Doelman Dairy \* Donnan Farms \* Edgar Farms \* Elm Knoll Farm \* Farmer's Cooperative Co. \* Freund's Farm \* George De Ruyter and Sons Dairy \* Giertz Brothers Farm \* Hack Farm \* Haubenschild Farm, Inc. \* Heartland Pork \* Henry's Ltd. \* Hickory Hill Dairy \* Homan Farms \* Johnson Farm \* Josies Pork Farm \* Keener Enterprises \* Langerwerf Dairy \* Laurel Brook Farm \* Martin Farms \* Matlink Farm \* Mountain View Farm \* MVP Farms \* Noblehurst Farms, Inc. \* Oakville Feed and Grain \* Palmetto Poultry \* Partners in Pork \* Penway Farm \* Perennial Pork \* Piney Woods School \* Pork Royal \* Rocky Knoll Swine \* Rondile, Inc. \* Savant Farms \* Schrack Farms Partnership \* Smithville Swine Systems \* Sugar Sand Hog Farm \* Swine USA \* Thom Edgar \* Thompson Farms \* Two Morrow's Pork, Inc. \* Veit Farms \* Walmore Holstein, Inc.

## Allies

A Fuel Company \* AgRES, Inc. \* Agricultural Engineering Associates \* AgPRO, Inc. \* AmeriScan Technologies Corp. \* Animal Environmental Specialists, Inc. \* Apple Valley Associates Limited \* Applied Science and Engineering \* Applied Technologies, Inc. \* Aqua Tech \* Bearden, Beaty & Assoc., Inc. \* Best Incorporated \* Biogas Industries, Inc. \* Bioreserve, Ltd. \* Brubaker Agronomic Consulting Service, Inc. \* C&S Engineers, Inc. \* Cal Poly San Luis Obispo \* Caterpillar \* Commonwealth Resource Management Corp. \* Convergent Biomass Technologies, Inc. \* County of Hennepin \* Creative Land Management International \* Cresmont Capital Projects, Inc. \* CSR America \* Curtis Engine & Equipment, Inc. \* D.J.F. Electrical Systems \* Duke Engineering & Services, Inc. \* Engineered Textile Products, Inc. \* Evergreen Bioservices \* Enviroenergy Systems, Inc. \* Environmental Fabrics, Inc. \* Envirotech Services, Inc. \* Farm Research & Energy Development Corp. \* Five-G Consulting, Inc. \* Geo Pacific Livens \* George Brothers \* Gothic Arch Greenhouses \* Great River Engineering, Inc. \* Grow Moore Products \* HIE Corporation \* IES, Inc. \* IONOVA □ J.E. Gasho & Associates, Inc. \* Jenbacher Energiesysteme, Ltd. \* Jet-Pro Company, Inc. \* LBI Technologies \* Matrix Management, Inc. \* Midwest Environmental Consultants \* National Methane \* Natural Power, Inc. \* Omega-Alpha Recycling Systems \* Oregon State University \* Permalon \* Poly-Flex, Inc. \* Poole Power Systems \* Power Strategies \* Production Specialties \* RCM Digesters, Inc. \* Reef Industries \* SEI, Inc. \* Sustainable Technologies, Inc. \* SWS Incorporated \* Tennant Limited \* The Stranded Gas Association, Inc. \* Tillamook PUD \* United Liver Company \* Universal Entech \* University of Arizona \* University of Florida \* Verditech \* Vermont Natural Agriculture Products \* Whessoe Varec

## Endorsers

Blue Ribbon Foundation \* County of Hennepin \* Iowa DNR \* Milk & Dairy Beef Quality Assurance Center \* Missouri and Mississippi Divide Resource Conservation and Development, Inc. \* Missouri Pork Producers Association \* National Association of Conservation Districts \* Society for Energy Efficiency



**GREAT RIVER ENGINEERING, INC.**

**Gregory Poole Power Systems**



Safe Environmental Inventions Inc.

## More Information??

For more information about on-farm methane recovery technologies or the AgSTAR Program, contact an AgSTAR representative at:

EPA AgSTAR Program  
501 3rd Street, NW (6202J)  
Washington, DC 20001

1-800-95AgSTAR (1-800-952-4782)  
(Hours of Operation: 9:00am to 5:00pm PST)

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