Illinois
Environmental
Protection Agency

Bureau of Water
1021 North Grand Ave. E.
Springfield, IL 62702

Special Issue
February 1999

Digester

over the spillway

"for optimum operation/maintenance of all water and wastewater facilities"

Act Now to Swat the "Millenium Bug"

Time is running out — Action is required now.

This special issue of Digester/ Over the Spillway contains important information about a computer problem which is being referred to as Year 2000, Y2K, or the "Millennium Bug."

Many computerized functions require recognition of a specific year, day and time, but most computers and computerized equipment recognize only the last two digits of a year's date. Therefore, when the calendar changes to the year 2000, many computers and equipment with embedded computer chips will have difficulty interpreting the correct date; they may interpret the year to be 1900 or some other year. A number of things are likely to happen: some computers and equipment will "crash"; others will operate erroneously; others may simply stop and need to be restarted; some may create data that looks correct but contains errors; and some may continue to operate correctly.

Many of Illinois' water and wastewater facilities operate with some level of computerization. Monitoring, operations and maintenance, communications, laboratory analysis and reporting are areas that should be assessed for potential Year 2000 computer related problems that could ultimately lead to public health and environmental problems.

It is important that utilities that have not already done so make any necessary changes and develop contingency plans that allow for "business as usual" on January 1, 2000. Time is running short. Action is required now. Drinking water and wastewater treatment plant owners and operators are, or should be, aggressively acting now to protect their systems from "Millennium Bug" caused failures on January 1, 2000.

The following article, obtained from US EPA's website — (www.epa.gov/year2000/ow.htm)— recommends a six step approach to help ensure normal operations on January 1, 2000. Information and assistance is also available from trade and professional associations, journals and websites. The manufacturers and industry experts can provide advice on specific systems.

TIMELINE

Highlight these dates on your calendar. You need to complete each assessment and correction step by these dates to be sure you are ready for business on January 1, 2000.

Assessment:
Start Now

Correction Deadline:
June 30, 1999

Contingency Plans Draft:
June 30, 1999

Testing/Validation Deadline:
June 30, 1999

Implementation Deadline:
Sept. 30, 1999

Final Contingency Plans:
Sept. 30, 1999

"The Millennium Bug":

Drinking Water and Wastewater Treatment Systems and Year 2000 Compliance

The U.S. Environmental Protection Agency(EPA) has been working collaboratively over the past few months with many associations which have an interest in the Year 2000 computer date problem and how the nation's drinking water and wastewater utilities are resolving it. This article is a result of this partnership and is offered as a public service to increase awareness and provide useful information on the issue as utilities continue to seek solutions to the problem.

Y2K, the Year 2000, or the "Millennium Bug" computer problem could adversely affect the operations of the nation's drinking water and wastewater treatment systems if it is not corrected. The Year 2000 issue is a potential problem for these systems because many of them use computers and equipment with embedded computer chips. If action is not taken now, the "Millennium Bug" could affect drinking water and wastewater operations, leading to public health and environmental problems.

The "Millennium Bug" is expected to arrive on January 1, 2000, (although other dates are impacted as well, as noted in this article). This is when millions of computers around the world will attempt to process date-specific information where the year is listed only as "00". Simple date calculations frequently involve subtracting one date from another. Many computers and embedded computer chips are programmed to recognize or record only the last two digits of a given year instead of the complete four digit date. For that reason, computers could end up with "negative" dates (which they don't recognize) or with completely wrong dates (if they interpret "00" as 1900 instead of 2000.) A potential problem exists whenever calculations based on actual dates are used within hardware or computer programs, applications, controls or procedures.

The arrival of this "Millennium Bug" could affect any computer and any kind of date-active device or software. Some computers and equipment will "crash"; others will operate erroneously; others may simply stop and need to be restarted; some may create corrupt data that will be assumed valid because it will not be readily detected; and some may continue to operate correctly.

The Year 2000 problem can affect any administrative system, such as payroll, billing, ordering and compliance reporting as well as plant operations. Since a large volume of information is already available on how to assess and repair such problems, this article focuses on actual drinking water and wastewater plant operations in order to assist plant managers in locating and correcting Year 2000 problems in their treatment systems.

WHERE IS THE PROBLEM?

Y2K problems in drinking water and wastewater treatment systems can occur in computers, computer software, and in systems that use computerized controls. Much attention has already been focused on finding and fixing those problems because they are the most obvious.

A less readily apparent, yet potentially serious, problem in drinking water and wastewater treatment systems could be caused by equipment with embedded computer chips. Many of these chips are time and date sensitive, relying on real-time clocks to perform their functions.

Embedded chips can be either single- or multi-purpose computerized devices that are literally embedded within equipment controls or control systems. Embedded chips can perform actual control and monitoring functions of the drinking water and wastewater treatment processes.

A real-time clock function is used for operations that are date or time specific. A real-time clock function can be programmed into any device, computer hardware or software package to record, store, or transmit actual time, day, and date. Real-time clocks might be found in processes or actions that must occur on a specific day of the week, or operations that must be repeated on a set cycle such as every other day or just weekends but not weekdays.

Examples of these processes in drinking water and wastewater treatment plants are: starting and stopping aeration blowers and pump motors; filling storage tanks; cycling of heating and ventilation systems; and monitoring equipment.

Depending on the treatment system, the Year 2000 problem may not exist (no automation), may exist only in specific pieces of equipment (some automation), or may exist not only in equipment but also in a Supervisory Control and Data Acquisition System (SCADA). Any drinking water or wastewater treatment system which might have equipment with this problem should be assessed and any needed repairs performed.

Digester/Over the Spillway

Published by the Bureau of Water, Division of Public Water Supplies and Division of Water Pollution Control.

Editor.....Joan Muraro

FINDING AND FIXING THE PROBLEM

The approach to dealing with Y2K problems has become fairly standardized. EPA recommends following a six-step approach, which is based on similar recommendations from industry and other government agencies. The approach has been adapted to apply to drinking water and wastewater treatment systems.

Because of the diversity of these systems, plant managers will need to tailor this approach to their systems. It is important to record plans, repairs, tests and test results to be able to revisit the process if the testing is not successful.

The six-step approach includes suggested dates by which activities in each step ought to be completed to help assure that systems are ready by January 1, 2000. (Note that all recommended dates should be treated as "no later than" dates. Sooner is better than later, particularly if new software, hardware or consulting services are needed.)

STEP 1. AWARENESS

(Complete As Soon As Possible)

While much of the United States population is aware that a Year 2000 computer problem exists, many people have not yet focused on what impact the problem might have upon them personally, or on their place of work or business. Also, many are not aware of the existence of the problem in equipment with embedded computer chips.

If your utility is not dealing with the problem yet, it may be necessary to promote awareness across the entire organization and all levels of leadership, including operating staff, supervisors, upper managers, and corporate or public officials.

There are many web sites, articles, conferences, and trade organizations which can help with raising the level of awareness about this problem. EPA has published an awareness Fact Sheet focusing on Y2K and drinking water and wastewater utilities which is available on the EPA Y2K web site at www.epa.gov/year2000/ow.htm or by writing to the U.S. EPA, Office of Water (4204), 401 M Street, SW, Washington, DC 20460.

At the end of this article is a list of web sites that could be useful for increasing understanding and awareness of the issue, as well as being sources of additional information. There have also been numerous articles in trade journals and the general news media that might be of interest. Additional reading from the list of references for this article may be helpful as well.

STEP 2. ASSESSMENT

(Complete As Soon As Possible)

The assessment stage is when a utility performs an inventory of all its computer systems, communications, and electrical equipment and determines what problems exist where, and what potential impact the problems will have. **This is the most crucial and perhaps the most difficult stage.**

Locating all of a facility's computers and embedded chips with real-time clocks can be difficult. Things that look like a computer are easy to find but control equipment, including Programmable Logic Controllers (PLCs) and equipment with embedded chips can be almost anywhere. Some problems may not be readily apparent, but may cause system failure.

Plant managers should be aware that dates other than January 1, 2000, could cause similar problems. Some of these dates are: 01/01/1999; 04/09/1999; 07/01/1999; 09/09/1999; 12/31/1999; and 02/29/2000. (2000 is a leap year). A more complete list is included in Appendix 1.

Every circuit board is suspect, but priority should be given to systems that ask for a date after a power failure, or have a back-up power source. Most newer systems use PLCs in place of conventional control systems. As the name implies, PLCs have a visual display or transmit data to a remote display terminal. These controllers can be programmed or reprogrammed by the operator. Older systems, however, may contain embedded timing devices that have no visual display of the real-time clock function, nor any means to see if a real-time clock function was installed at the factory.

Most computerized control systems and telemetering systems also contain some type of real-time clock function. These monitoring systems alert the operator about equipment problems, breakdowns and malfunctions. They also record and transmit data from remote locations showing the exact date and time of the problem.

Even chips without real-time clock functions may have been programmed with default values. In the event of a Year 2000 failure, these chips may malfunction or revert to the default value. These devices are often found in systems such as power, security, heating and ventilation, telephones, elevators, monitoring, and process controls.

To jump-start the assessment process, we have provided a quick check list (Appendix 2) of the most probable locations to find embedded chips in drinking water and wastewater treatment systems. These are only examples; drinking water and wastewater treatment facilities vary in their processes and equipment so each plant needs to be examined individually.

To assess Year 2000 compliance:

- **Define Year 2000 Compliance.** In general, "ready" or "compliant" means that the system and technology-based equipment (hardware, software, interfaces, etc.) will continue to produce understandable, accurate and predictable results that conform with the original functional specifications, regardless of the millennium change. Different businesses and organizations may strengthen the definition of Year 2000 compliance at their option, but usually the minimum Year 2000 compliance standard includes:

- The transition to dates in the Year 2000 will not interrupt the system's operation.

- The transition to dates in the Year 2000 will not cause "real-time" calculations to be interrupted, or cause sequential events from prior dates to be displayed, archived or executed in an improper order.

- Data is stored and transmitted in such a manner that relative time will be maintained, and can be either explicitly (the date is explicitly stored as an absolute value) or implicitly (the actual date is calculated based on some offset or other criteria) determined for a defined range of possible dates.

- The system will correctly recognize Year 2000 as a leap year.

- **Locate and inventory all computerized equipment and real-time clock functions in embedded chips.** Record all model and serial numbers for reference. If you need assistance, contact the appropriate equipment supplier in writing or visit their website if they have one. There are also centralized Y2K compliance databases that are subscription based. Note: each manufacturer or supplier may have a different standard for Year 2000 compliance; ask for their definition of compliance.

- **Analyze risk and impacts of failure when problems are found.** The seriousness and impact of the problem should be weighed to help determine the best course of action. Based on the seriousness of the impact, the decision could be to take no action, to repair, or to replace.

- **Assess vulnerabilities external to drinking water and wastewater treatment systems.** These may include power, telecommunications and transportation systems, and chemical and equipment suppliers. Drinking water and wastewater facilities should be cognizant of each other's vulnerabilities as well, and should also be familiar with upstream dischargers' Y2K readiness status. It will be important to meet with power company managers, telecommunications utility managers, and chemical and equipment suppliers to understand risks involved and to ensure that these external service suppliers have included drinking water and wastewater systems in their contingency plans at equally high priorities. Just as important, the external service suppliers should be familiar with the contingency plans of the drinking water and wastewater systems.

- **Develop or revise contingency plans (see Step 6).**

STEP 3. CORRECTION

(Complete by 06/30/1999)

After assessing a system, steps need to be taken to correct the problems. These may include:

- **Prioritization of system conversion and replacement, and establishment of a schedule.** This should be based on risk, potential liability of failure, time needed to repair, and any other pertinent factors.

- **Modification, repair or replacement of the system or components identified as potential problems during the assessment phase.**

- **Engagement of consulting firms and computer specialists, if necessary, to assist in making corrections.**

STEP 4. TESTING/VALIDATION

Complete by 07/31/1999

Owners and operators of facilities should carefully evaluate the public health and environmental impact of plant failure during testing. They should take steps to prevent failure and mitigate resulting adverse impacts if testing activity fails. All testing plans, procedures and results should be thoroughly documented for internal Y2K contingency planning, including:

- **Full operations test on converted or replaced system components to demonstrate Year 2000 compliance.**

- **Consideration of applications, database interdependencies and interfaces.**

- **Independent verification of Year 2000 compliance and operational readiness, if appropriate.**

STEP 5. IMPLEMENTATION

Complete by 09/30/1999

During implementation, utilities should put their repaired systems back into full operation having adjusted for issues found during assessment, correction, testing and validation. This also means having contingency plans available and ready to operate. Other important steps in implementation include:

- **Customer notification and communication of a utility's Year 2000 readiness.** Bill stuffers, newspaper ads, and radio commercials are some ways to reach both business and residential customers.

- **Establishment of a "customer hotline" or an Internet site.** This will make it easier for customers to get information upon request. Customer service representatives should be familiar with the Year 2000 issue and be able to answer

questions or direct calls to the appropriate staff.

- **Documentation of all internal and external efforts to achieve Year 2000 compliance.** If everything has been documented and a treatment system experiences problems in spite of compliance efforts, a baseline will exist for analyzing and "debugging" the system.

- **Back-up contract services.** Make sure all contracts are in place, all vendors and suppliers have been notified and all necessary chemicals and materials are on hand.

- **Notify local emergency management organizations of contingency plans and Year 2000 readiness.**

STEP 6. CONTINGENCY PLANS

Draft by 06/30/1999;
Finalize by 09/30/1999

Despite the best efforts to repair the Y2K problem and prepare for its impact, problems may still arise. Therefore utilities must develop effective and thorough contingency plans.

Most drinking water and wastewater treatment plants have contingency plans for operating during natural disasters such as floods, hurricanes and earthquakes. The Year 2000 problem may be similar to these emergencies, since it represents a potential disruption in operation of local utilities, but the plans should still be adapted for the Y2K situation. In particular, the plans should address internal failures and the failure of service and supply chains external to the facility.

Since the Year 2000 begins on a Saturday, the need to have additional operating personnel available to handle any problems that might occur at the plant or in the collection or distribution system should be considered. Staff should have two-way radios to allow communication between locations if telecommunications systems are down. Consideration should be given to having additional customer service representatives available to handle inquiries and complaints.

Owners and operators should check with contractors, vendors and utility suppliers to ensure that they are Year 2000 compliant and that power, gas, telecommunications service, chemicals and other supplies will be delivered as scheduled. All contracts and maintenance agreements should be checked to identify vendor or contractor responsibilities and warranties for Year 2000 compliance. Be sure all new contracts and agreements require Year 2000 compliance certification. Insurance coverage should be evaluated against business interruptions, claims regarding environmental damage and consequential damages from Year 2000 compliance failures.

Appendix 3 lists some examples of problems that might occur and possible contingency plan solutions. Owners and operators should consider contingency plan options during the assessment phase of preparing for the Year 2000, and revisit these plans during the testing/validation phase. Contingency plans should include:

- **Development of plans, among other things, of how systems would be manually operated until the computerization problems or external impacts are resolved.** Include contingencies for larger staff if manual operations become necessary.

- **Revision of contingency plans after the testing/validation phase, as needed.**

WHERE TO GET ADDITIONAL INFORMATION AND ASSISTANCE

Considerable information on Year 2000 problems and solutions is currently available on the Internet from the federal and state governments, consultants, manufacturers and vendors, trade and professional associations, and other private sector groups. A list of web sites is included in Appendix 4. Although not inclusive, it should provide useful additional information and assistance.

WORK TOGETHER!

The Year 2000 will be here very soon and by now many utilities have finished their repairs and completed their testing. Wherever possible, these utilities should help alert neighboring utilities to this problem, and to make any useful information gleaned from their own repair process available to those still working to get ready for Y2K. If we all work together, we will successfully treat this "Millennium Bug."

This article was prepared cooperatively by Office of Water staff at the Environmental Protection Agency. Please feel free to contact any of the following for additional information:

James Wheeler	Office of Wastewater Management	202/260-5827
Steve Clark	Office of Ground Water and Drinking Water	202/260-7159
Barry Benroth	Office of Wastewater Management	202/260-2205
Barbara Jarvis	Office of the Assistant Administrator	202/260-0173
Nancy New	Office of the Assistant Administrator	202/260-4732

APPENDIX 1

IMPORTANT DATES TO CHECK FOR THE "MILLENNIUM BUG"

DATE	REASON FOR CONCERN
01/01/1999	Systems that look one year ahead may fail.
04/09/1999	Special-use Julian date (99th day of 99th year).
07/01/1999	Many governments begin their fiscal year.
08/21/1999	Global Positioning System date rollover affects military, transportation, Geographic Information System, and Automatic Vehicle Locator.
09/09/1999	Programmers use 9/9/99 as an end of file or infinity; will cause numerous problems (ninth day of ninth month of 99th year).
10/01/1999	Federal government and others begin FY 2000.
12/31/1999	End-of-year baseline (to be used in rollover scenario).
01/01/2000	Date rollover will halt, confuse, or otherwise disrupt many systems and devices.
01/02/2000	First 24-hour look back period.
01/10/2000	First date requiring full use of seven digits.
02/28/2000	Day prior to Leap Year (to be used in rollover scenarios).
02/29/2000	Many systems will not recognize Leap Year in 2000.
02/30/2000	Invalid date. Test to ensure that Leap Year logic is functioning.
03/01/2000	First valid date after Leap Year.
10/10/2000	First date requiring full use of eight digits; may cause failures.
12/31/2000	Some systems using Julian dates may not recognize the 366th day of the Leap Year.
01/01/2001	First date in 2001. Check rollover functions.

Sources: Texas Guidebook 2000 and California Year 2000 Embedded Systems Program Guide.

APPENDIX 2

POSSIBLE LOCATIONS OF EMBEDDED CHIPS IN DRINKING WATER AND WASTEWATER TREATMENT FACILITIES

Communications Infrastructure

- Auto dialers
- Network bridge and routers
- Portable radio communication equipment
- Uninterruptible power supplies
- Wireless transmitters and receivers
- Voice/Data telecommunications equipment, including cell phones and pagers
- Uninterruptible Power Supplies Instrumentation and Ancillary
- Automatic calibration systems
- Automatic sampling equipment
- Chemical analyzers
- Chemical feeders
- Hand held calibration equipment
- Lab and quality control instruments
- Maintenance diagnostic instruments
- Liquid flow meters (batch/totalizing)

Facilities and Support

- Battery chargers
- Building Heating, Venting, and Air Conditioning (HVAC) systems
- Building security systems
- Eyewash systems
- Fire and smoke alarm systems
- Programmable machining equipment
- Guard control systems
- Weather monitoring systems
- Uninterruptible Power Supplies
- Geographic Positioning System (GPS)
- Diagnostic Engine Analyzers
- Automated Fueling Systems

Materials Tracking

- Automated warehousing systems
- Bar code readers and printers
- Product/materials labeling and printing
- Wireless data terminals

Production and Process

- Automated reconditioning/regeneration systems
- Distributed control systems
- Local controllers (programmable)
- Operator interface hardware
- Power monitoring equipment
- Programmable logic controllers (PLCs)
- Weight scales
- Demand management controls
- Hand held programming terminals and equipment
- Message displays
- Operator interface software
- Programmable chart recorders
- Data loggers
- Proprietary communications interfaces
- Supervisory Control and Data Acquisition System (SCADA) hardware and software
- Meter reading equipment
- Remote terminal units

Process Controls

- Flow meters
- Pump motor controllers
- Level controllers
- Flow controllers
- Chemical feeders
- Mixer speed controllers
- Aeration blower controllers
- Chlorinators

APPENDIX 3

EXAMPLES OF ISSUES TO CONSIDER IN CONTINGENCY PLANS

CAUSE	EFFECT	POSSIBLE CONTINGENCIES*
Power failure.	Pumping stations overflow resulting in discharge of inadequately or untreated wastewater.	Have on-site emergency power generating capacity to operate critical treatment processes. Consider use of hydroelectric, solar power, or biogases that are generated on site as emergency fuel sources.
Natural Gas/Fuel source failure.	Incinerators and boilers must be shut down; Heating, Venting and Air Conditioning (HVAC) systems inoperable.	Use propane space heaters for heating key buildings. Explore alternative sources of fuel for other critical facilities and functions.
Vendors experience Y2K caused failures.	No chemicals or spare parts are available.	Stockpile additional chemicals, supplies, fuel oil, spare parts.

APPENDIX 3 *(continued)*

EXAMPLES OF ISSUES TO CONSIDER IN CONTINGENCY PLANS

CAUSE	EFFECT	POSSIBLE CONTINGENCIES*
Telecommunications systems fail.	No communication between central and remote locations; inaccurate or no data recorded or reported.	Use two-way radios to monitor or control remote locations manually.
Supervisory Control and Data Acquisition (SCADA) system fails.	System may not report accurate data or may report no data at all; operator may not be able to control plant operations.	Plan for additional operating personnel, equipped with two-way radios, to manually operate critical treatment processes.
Laboratory equipment malfunctions.	Cannot track samples; inaccurate analytical data or no data reported.	Provide additional operating personnel, skilled in laboratory procedures, to analyze and record data. Include a system to provide needed laboratory results to the operating personnel so plants can continue to run effectively. If using an off-site or contract laboratory service, be sure they are Year 2000 compliant.
Customer billing, payroll, scheduling, ordering and invoicing, inventory and other administrative management systems fail.	Over billing or no billing of customers; inaccurate payroll information; orders and invoicing of needed materials, chemicals and supplies disrupted.	Additional operating personnel needed to perform administrative functions manually.
HVAC system failure.	No heat for occupied areas or key processes resulting in freezing; lack of ventilation results in odors, volatile vapors and hazardous fumes building up in confined spaces leading to toxic or explosive atmospheres (such as in pumping stations, tunnels, sumps and pits, sludge gas processing buildings, and other enclosed areas.)	Emergency generators or alternate power sources needed for proper ventilation to be maintained; space heaters and portable ventilators should be on hand.

* Contingencies will vary from plant to plant. Utility managers should assess their own risks and evaluate contingency needs. Meetings with external suppliers, especally power and telecommunication providers, are strongly encouraged.

APPENDIX 4

IMPORTANT WEB SITES ON Y2K

http://www.y2k.gov/java/index.htm (President's Y2K Council)

http://www.epa.gov/year 2000 (Environmental Protection Agency)

http://www.epa.gov/year 2000/ow.htm (EPA-Office of Water)

http://itpolicy.gsa.gov (General Services Administration)

http://www.dtic.mil/c3i/y2k/plan.html (Department of Defense)

http;//www.nist.gov/y2k/ (Department of Commerce)

http://www.gao.gov (General Accounting Office)

http://www.amsa.org (Association of Metropolitan Sewage Agencies)

http://www.wef.org (Water Environment Federation)

http://www.amwa-water.org (Association of Metropolitan Water Agencies)

http://www.awwa.org (American Water Works Association)

http://www.apwa.net/resource center/pwadmin.htm#y2k (American Public Works Association)

http://www.itaa.org (Information Technology Association of America)

http://www.wwema.org (Water and Wastewater Equipment Manufacturers Association)

http://www.isa.org (International Society of Measurement and Control)

http://www.ema-inc.com (Electrical Manufacturers Association)

http://www.y2kjournal.com (private sector information)

http://www.y2k.com (private sector information)

http://www.swrcb.ca.gov/html/y2k.html (California State Water Resources Control Board)

http://www.dir.state.tx.us/y2k/resources/guide 2000.PDF (State of Texas Guidebook 2000)

http://www.boma.org (Building Owners and Managers Association)

http://www.year 2000.ca.gov. (State of California)

REFERENCES

1. "Software Inspection and the Year 2000 Problem," O'Neill, D., Independent Consultant, @ http: //www.stsc.hill.af.mil/CrossTalk/1998/jan/y2kinspection.html.

2. "Policy-Systems", Elsag Bailey Process Automation, @http://www.ebpa.com/apps/apps006a.html.

3. "The Year/2000 Embedded Systems Threat to Core Infrastructure Services," Martin, R. @http://ourworld.compuserve.com/home-pages/roleigh_martin.

4. "Year 2000: How Your Utility Can Avoid Disaster," Ladner, R.L., Westin Consulting, San Jose, CA, and Leake, G. A., Westin Consulting, Seattle, WA, 1998.

5. "Bitten by the "MILLENNIUM BUG," Canadian Water and Wastewater Association, Bulletin, Volume 12, Number 6, July 1998. http://www.cwwa.ca.

6. "Water Industry Must Prepare for New Millennium," American Water Works Association, Waterworld Magazine, May 1998. http://www.awwa.org.

7. "Federal Government Year 2000 Activities," Warner, C. M., General Services Administration @ http://www.itpolicy.gsa.gov.

8. "Year 2000 Management Plan," Benesch, W., Department of Defense, @http://www.dtic.mil/c3i/y2k/plan.html#objectives.

9. "Year 2000 Computing Crisis: An Assessment Guide," GAO/AIMD-10.1.14, General Accounting Office, Washington, D.C., 20548. April 1998. http://www.gao.gov.

10. "Model Year 2000 Action Plan for Water Utilities," Association of Metropolitan Water Agencies @ http://www.amwa-water.org/y2k/action_plan.html.

11. Texas Guidebook 2000. Carolyn Purcell, Department of Information Resources. The State of Texas. Austin, TX. http://www.dir.state.tx.us/y2k.

12. "Meeting the Year 2000 Challenges." Building Owners and Managers Association. http://www.boma.org

13. California Year 2000 Embedded Systems Program Guide. June 1998. http:// www.year2000.ca.gov.

Digester/Over the Spillway
Published by the State of Illinois
Environmental Protection Agency
Box 19276
Springfield, Ill. 62794-9276

BULK RATE
U.S. Postage Paid
Springfield, Ill. 62706
Permit No. 704

Printed on Recycled Paper Using Soy-Based Inks