UTILITIES

The Committee has taken a broad-based approach to utilities—aggregating electrical power, gas and oil, and water (drinking and wastewater) in this sector. Telecommunications—is discussed separately in another section of this report.

ELECTRIC UTILITIES

One of the most often asked question concerning Y2K is, "will the lights stay on?" In general, the answer is yes. However, progress in assessing, remediating, and testing is insufficient to answer this question absolutely. As with other sectors, some general conclusions can be drawn. First, the large corporations, or bulk power producers, are spending vast resources to get the Y2K problem under control. However, each of the 3200 electric utilities is at a different stage of remediation, and many may experience problems. All of the evidence seems to indicate that there may be isolated and diverse electrical outages across the country. The questions now are: Where will they occur, how long will they last, and will they be significant enough to affect the overall grid?

ELECTRICAL POWER IS KEY TO EVERY OTHER SECTOR: THE LIGHTS MUST STAY ON!

The Committee made electric utilities its top priority because of its critical importance to everything else—without electric power little else will work. As a result, the status of electric power is the number one concern for all other sectors.

Overview

There are about 3,200 independent electric utilities in the United States including about

- 250 investor-owned or private utilities,
- 10 government-owned utilities,
- 2,000 other publicly owned utilities, and
- 900 cooperatives.

Nearly 80% of the nation's power generation comes from the 250 investor-owned public utilities. The federal government generates another 10% of the nation's power, primarily through large facilities such as the Tennessee Valley Authority and the Bonneville Power Authority. There are another 2,000 non-utilities, or privately owned entities, that generate power for their own use and/or for sale to utilities and others.

Electric power is generated from the following sources:

- 51% by coal
- 20% by nuclear energy
- 15% by gas,
- 10% by hydro, and
- 4% by other sources.

The approximately 900 cooperatives

generally have limited power-generation capacity and focus primarily on distribution systems.

The electric power industry is complex and highly automated. It is made up of an interconnected network of generation plants (nuclear, fossil fuel, gas, hydro, etc.), transmission lines (commonly referred to as the "grid"), and distribution facilities. There are three independent interconnections or grids that provide electricity to every household and company in North America (See figure 1.)

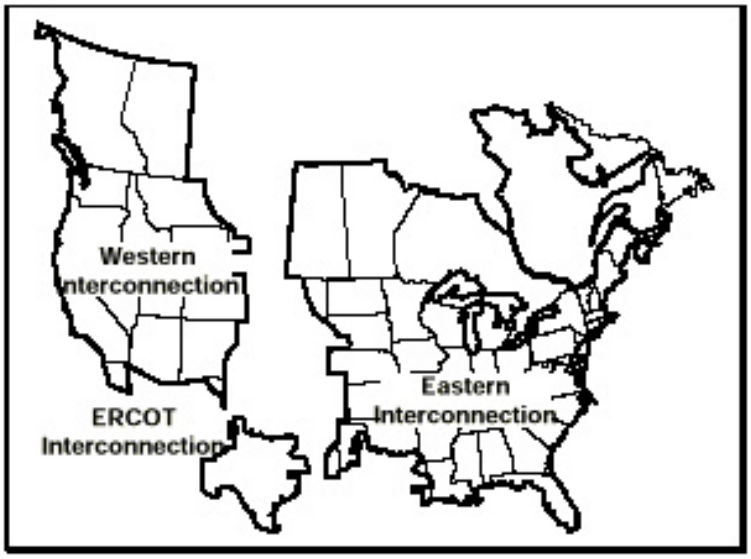

Figure 1: North American "Grids"

In its simplest form, each of these grids operates as a single machine, constantly making adjustments to balance the amount of power being generated with the amount being used. These adjustments are critical because electric power cannot be stored. Too much power could literally melt transmission and distribution lines; too little power could result in brown outs.

It takes a high degree of automation to operate the grid. On one hand, it is this high degree of interconnectedness that gives the system its unprecedented reliability and efficiency. On the other hand, the interconnectedness makes the grid fragile and susceptible to Y2K disruptions. An outage in one part of the grid can cascade causing ripple effects on other parts of the grid. For example, a generation plant could go out in Maine, affecting power in Florida.

The basic structure of an electric power transmission and distribution system consists of a generating system, a transmission system, a sub-transmission system, a distribution system, and a control center. Power plant generation systems may include steam turbines, diesel engines, or hydraulic turbines connected to alternators that generate AC electricity. This configuration is illustrated in figure 2.

In most respects, the electric industry faces the same Y2K challenges as every other industry. Y2K anomalies could lead to the malfunction of software programs on mainframe computers, servers, PCs, and communications systems. Corrupted data could be passed from one application to another causing erroneous results or shutdowns. This means computer programs used for accounting, administration, billing,

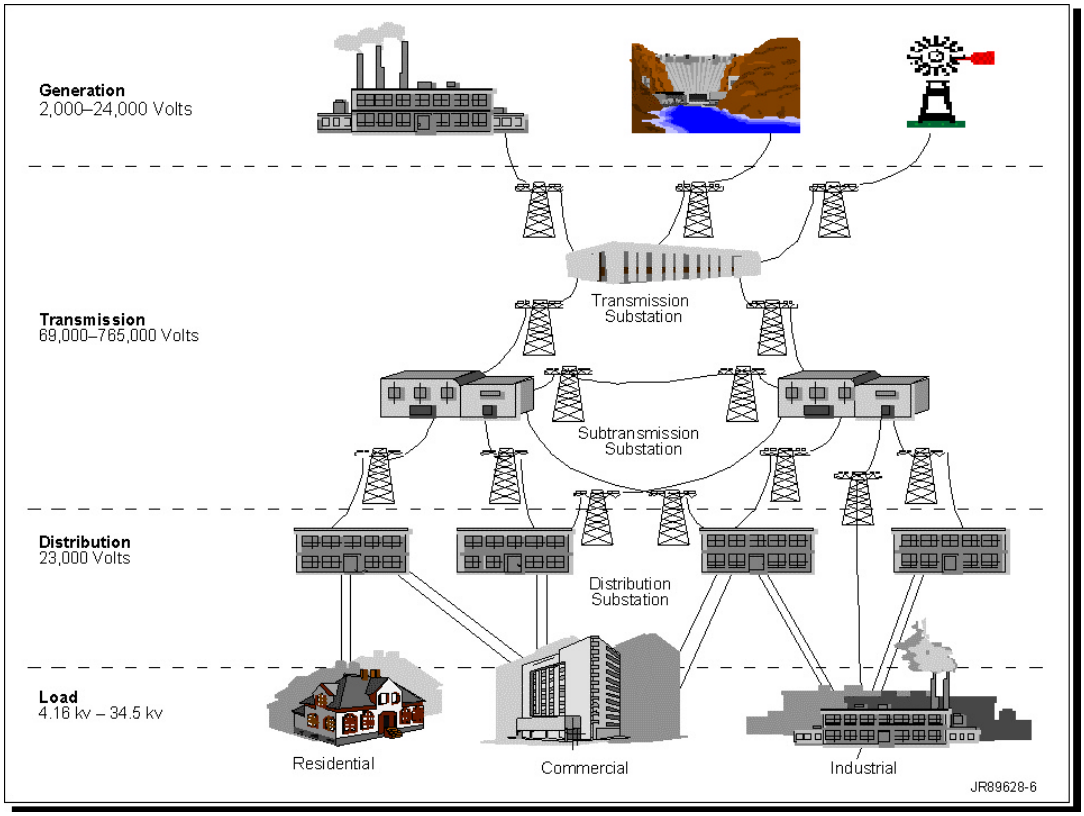

Figure 2: Electric Power Components

and other important functions could experience problems.

Of greater concern to the electric power industry are embedded computers—small electronic chips or control devices. These chips are used extensively in all parts of the electric power industry including generating plants, transmission lines, distribution systems, and power control systems. Even though only a small number of these embedded devices will have a Y2K problem, it is impossible to tell which ones until each chip has been checked and tested—a time consuming venture.

Making matters worse, electronic chips are generally mass-produced without knowing the ultimate application of the chip. A single circuit board can have 20–50 of these chips from various manufacturers. Because of the diversity of chip suppliers, one vendor may use a different mix of chips even within devices labeled with the same name, model number, and year. Many of these chips have built-in clocks that may experience date change anomalies associated with Y2K

There are numerous mission critical systems essential to the production, transmission, and delivery of electric power. Y2K risks in electric power can be grouped into five areas.

1. Power Production Systems

Generating units must be able to operate through critical Y2K periods without disruption. Units that are scheduled to operate must be able to start up and deliver electricity as planned. The threat is most severe in power plants with Digital Control Systems (DCSs). Many older plants operating with analog controls may be less problematic. Numerous control and protection systems within the DCS use time-dependent algorithms, which may result in generating unit trips when encountering a Y2K anomaly. Digital controllers that have been built into station equipment, protection relays, and communications may also pose risks.

2. Energy Management Systems

There are approximately 200 bulk electric control centers in North America. From these control centers, system operators monitor and control the backbone of the electrical systems and dispatch generation to meet demand. Computer systems within these control centers use complex algorithms to manage the operations of transmission facilities and to dispatch generating units. At any moment in time, a percentage (usually 10–20%) of generating units may be on automatic control for the purpose of following load and regulating interconnection frequency. Many of the control center software applications contain built-in time clocks used to run various power system monitoring, dispatch, and control functions. Some energy management systems are dependent on time signal emissions from Global Positioning Satellites. Beyond the 200 operating centers, there are hundreds of additional control centers used to manage subtransmission and distribution systems. These systems are typically operated using a subset of an energy management system, called Supervisory Control and Data Acquisition (SCADA).

3. Telecommunications Systems

Electric power systems are highly dependent on microwave, telephone, VHF radio, and satellite communications. If the control centers are the "brains" of the electrical grids, communications systems are the "nervous system." Telecommunications is the single most important area in which the electric systems depend on another industry. Many of the telephone, microwave, and network services used for communications in the electric industry are provided by telephone companies and other communications and network service providers. The dependency of electric supply and delivery systems on external service providers is a crucial factor in successful performance during Y2K transition periods.

4. Substation Control Systems

Throughout electric transmission and distribution systems there are substations that contain control equipment such as circuit breakers, disconnect switches, and transformers. Remote terminal units (RTUs) in substations serve as the communications hubs for the substations,

allowing them to communicate with the control centers. Substations also contain most of the transmission and distribution system protection relays, which serve to operate circuit breakers to quickly isolate equipment should an electrical fault occur on a line, transformer, or other piece of equipment.

5. Distribution Systems

Distribution systems deliver electricity from the transmission network to customers. There is a lot of commonality in the types of substation equipment in distribution compared to transmission. Distribution systems have additional equipment outside substations (for example, along a distribution feeder) that may have electronic controls. Examples include reclosers (relays that open and close a feeder in rapid succession to allow a fault to clear), capacitors, voltage regulators, and special monitoring devices.

Although the five areas outlined above focus directly on the production and delivery of electricity, other support systems are essential to sustained operations of the electrical service provider. These systems have been grouped under the heading "Business Information Systems" in this report. They include among others customer service call centers, supply and inventory systems, and accounting systems.

Major Players

Several federal organizations are involved in various aspects of the electric power industry. Primary are the Department of Energy's (DOE) whose mission is to formulate a comprehensive energy policy encompassing all national energy resources, including electricity; and the Federal Energy Regulatory Commission (FERC), an independent agency overseeing the natural gas industry, the electric utilities, non-federal hydroelectric projects, and oil pipeline transport. Other federal agencies that oversee the electric power transmission and distribution industry include

- the Nuclear Regulatory Commission (NRC),
- the Rural Utility Service (RUS),
- the Environmental Protection Agency (EPA), and
- the Securities and Exchange Commission (SEC).

At the request of DOE, the North American Electric Reliability Council (NERC)—a non-federal entity—has assumed the primary role in monitoring the overall Y2K preparedness of the electric power industry. NERC is a logical choice for this role because it is the organization most involved in keeping the lights on in North America.
Formed in 1968 in response to a cascading blackout that left almost 30 million people without electricity, members are drawn from all ownership segments of the industry—investor-owned, federal, state, municipal, rural, and provincial. NERC is a nonprofit corporation composed of ten regional councils.

The members of the regional councils are electric utilities, independent power producers and electricity

marketers that account for most of the electricity supplied in the United States, Canada, and Mexico.

State public utility commissions (PUCs) play the most significant role regulating the electric power industry. PUCs control the rate structure for all municipal utilities, investor-owned utilities, and rural electric cooperatives that own, maintain, or operate an electric generation, transmission, or distribution system within a state. By controlling what constitutes an allowable charge, classifying accounts, and structuring rates, the PUCs can exert significant influence over utilities. The PUCs also regulate reliability for both operational and emergency purposes, oversee territorial agreements, and resolve territorial disputes between utilities.

Other significant Y2K players in the electrical power industry include the:

- American Public Power Association (APPA)
- Electric Power Research Institute (EPRI)
- National Rural Electric Cooperative Association (NRECA)
- Edison Electric Institute (EEI)
- Nuclear Energy Institute (NEI)
- Canadian Electric Association (CEA)

Major Initiatives

The Senate Year 2000 Committee held its first hearing on energy utilities on June 12, 1998. We received testimony from Administration officials and key players in the electrical power industry including John Koskinen, Chairman, President's Council on Year 2000 Conversion; Elizabeth Moler, Deputy Secretary DOE; Shirley Ann Jackson, Chairman, NRC; Michehl Gent, President, NERC; and Dr. Charles Siebenthal, Manager Y2K Programs, EPRI. In addition, because of the lack of data on the overall status of the electric power industry, the Committee conducted a survey of large electric and gas and oil utilities.

The Committee's survey results clearly indicated that electric utilities did not have an accurate picture of their current state of Y2K readiness. Most utilities had just begun to assess their systems and embedded devices

John Koskinen outlined the structure of the President's Y2K Council and reported that DOE would head the electric power sector.

DOE testified that it lacked the regulatory authority to force industry compliance. DOE asked NERC for help in building an understanding of Y2K efforts in the electric power industry. NERC also assumed responsibility for surveying the industry.

APPA, where members include many state and local municipal electricity providers, is coordinating information sharing and surveys of its members, as well as smaller non-member public power utilities. APPA is assisting NERC in the industry-wide readiness review of electric distribution systems.

EPRI is focusing its Y2K program on embedded systems and the associated Y2K technical and project management issues. Over one hundred companies are participating in the EPRI information-sharing program, representing over 74 percent of the electric power consumed in North America.

EEI represents investor-owned utilities. It has established a program to address Y2K technical, regulatory, and liability issues. EEI is also assisting in the readiness review of electric distribution systems.

NRECA is coordinating Y2K readiness assessments and information sharing among its membership, which includes nearly 1,000 rural electric systems.

NEI is coordinating the assessment of Y2K readiness of U.S. nuclear facilities and is providing that information as part of the NERC surveys.

CEA is assisting NERC by coordinating efforts in Canada, particularly to address the readiness of electric distribution systems and Canadian nuclear facilities.

Assessment

At the time of the hearing, there was a lack of industry-wide survey data of the electric power industry. As a result, the Committee staff surveyed five large electric and five large gas and oil companies to obtain cursory readiness information. Figure 3 below displays the result of the survey.

Based on the survey results, the Committee concluded that the utilities were proceeding in the right direction, but the pace of remedial efforts was too slow and there was so much remaining to be done that there was significant cause for concern. Only two of the eight firms reported completion of assessment, making assertions of Y2K compliance by December 1999 highly suspect. Committee concern was heightened because the most difficult tasks—renovation and testing—were yet to come.

The utilities' lack of information regarding Y2K compliance of their major suppliers, vendors, and service providers created additional concerns about the utilities assertions of readiness. The survey results raise significant levels of concern given that the firms surveyed were among the largest utilities and were dedicating many resources to Y2K (collectively over $400 million). Smaller firms with fewer resources are presumably further behind in their Y2K remediation efforts.

On September 17, 1998, three months after the Committee's hearing, NERC issued its first comprehensive report of electrical power industry readiness based on survey data collected at the end of August. It has issued two monthly updates since that time. Participation by the 200 bulk electric operating entities increased from 144 in August to 155 and 188 in the September and October surveys, respectively.

Company	Date Aware	Establish Formal Project	Assessment Complete	Percent Systems Mission Critical	Status of Service Providers/ Vendors	Legal or Liability Concerns	Contingency Plans Complete	Contacts By Creditors	Contacts by Investors	Will You Finish In Time
1	1995	Yes	No	54	?	Yes	No	Yes	-	Yes
2	1995	Yes	Yes	5	?	Yes	No	Yes	Yes	Yes
3	1996	Yes	No	?	?	Yes	No	No	Yes	Yes
4	1992	Yes	No	30	?	Yes	No	Yes	Yes	Yes
5	1995	Yes	Yes	50	?	No	No	Yes	Yes	Yes
6	-	Yes	No	?	?	Yes	No	Yes	Yes	Yes
7	1996	Yes	No	?	?	Yes	No	Yes	Yes	Yes
8	1996	Yes	No	25	?	No	No	Yes	Yes	Yes
9	1996	Yes	No	35	?	Yes	No	Yes	Yes	Yes
10	1996	Yes	No	18	?	No	No	Yes	Yes	Yes

Figure 3: Committee Survey Results

About 2,200 of the 3,000 distribution entities, i.e., the actual electric utilities have participated in the NERC process by responding to data gathered by APPA and NRECA and providing it to the appropriate bulk electric operating entity. NERC's overall survey results are depicted in figure 4.

While the NERC surveys clearly show progress in August, September, and October, the question is whether there is sufficient time to complete Y2K remediation efforts. The data presented in the NERC report do not seem to support the optimistic tone contained in the report's executive summary. Of particular concern is that, with only a little over a year to go, 34% of the firms are operating without a written plan.

In addition, the assessment phase is only 75% complete (federal agencies are 99% complete with this phase). Remediation and testing is only 36% complete. Given that Y2K experts contend that between 40 and 70% of the total effort will be expended in testing alone, there may not be sufficient time to complete this.

The highly interconnected nature of the grids raises concern about cascading failures. This in turn obviates the need for contingency plan-

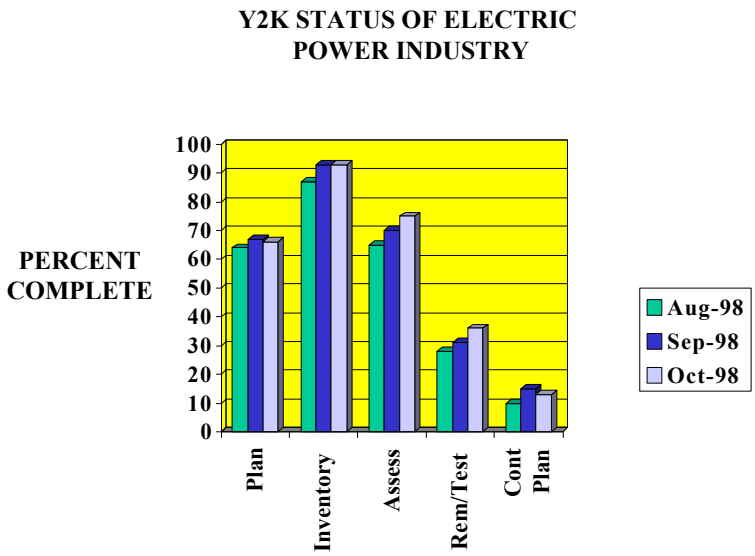

Figure 4: NERC Monthly Status Reports

ning, particularly plans for addressing capacity shortages and overages—of which only 13% of the firms surveyed have in place.

Although nuclear plants are addressed in the overall NERC study, public concern about their safety dictates that the Committee provide specific information regarding the overall Y2K preparedness of these plants. Nuclear facilities are lagging behind other electric facilities in their Y2K assessment and remediation efforts.

In general, nuclear facilities contain very old analog technology and, as a result, have fewer Y2K issues than the more digital and modern fossil fuel facilities. Nevertheless, assessments to date have revealed varying degrees of problems in areas such as plant process control, feed water monitoring, refueling, turbine control, and building security and access control.

While these problems should not affect plant safety, they could cause serious electricity production problems. While NRC has legal authority only to address plant safety issues, it is working closely with NEI to assess nuclear plants. NRC plans detailed Y2K assessments of 12 of the nearly 70 nuclear facilities. It has completed assessments on six of these plants, and has issued reports on the first three. These reports are publicly available on NRC's web site.

Concerns

- While complete power grid failure and prolonged blackout is highly unlikely, failure of at least some parts of the electric power industry, e.g., local or regional outages, is possible. The 3200 electric utilities are at various stages of remediation. The likelihood of outages in a given area is directly related to the overall preparedness of the individual electric utility serving that area.

- Overall Y2K remediation progress has been slow due to the industry's late start, the complexity of the power grids, and the magnitude of the problems. As a result, power companies must

step up their efforts, and develop workable contingency plans in the event their best efforts fall short.

- The interconnectivity of the electric generation and transmission entities making up the grids is a strength and a weakness. On the one hand, interconnectivity provides flexibility in that electricity can be routed around trouble spots. On the other hand, outages in one part of the grid could affect power in other parts of the grid. There are no comprehensive studies concerning the number of entities that would have to fail to put the entire grid at risk, but some experts suggest that it may be a very small percentage if in key locations.

- The interrelationship of the electric power sector with other sectors it depends on—telecommunications, natural gas and oil supplies and pipelines, and rail transportation for coal supplies—requires close coordination. There are signs that this coordination is beginning, but efforts need to be stepped up so that the electric utilities can engage in more meaningful contingency planning.

- The bulk power entities are spending large amounts of money on Y2K remediation and most are making good progress. Of greater concern are some of the smaller and medium-sized distribution entities that may not have sufficient resources to devote to the problem. Each is an essential link to the overall success of the industry.

- State public utility commissioners must play an active role in ensuring that the electrical utilities under their purview are taking appropriate Y2K remediation, risk reduction, and contingency planning actions. In addition, they should keep the public informed about the status of the utilities.

- Nuclear plants are at various stages of Y2K remediation. Some have only recently begun to assess the systems within their plants. Even if for no other reason than to allay public concern, NRC needs to expand its detailed Y2K assessments to include all nuclear plants. In addition, not withstanding the NRC charter of addressing safety issues only, it needs to broaden the scope of its Y2K assessments to include operational issues as well.

- The electric industry is in the middle of a major restructuring to introduce wholesale and retail competition for electricity. Attention has been on competing in the marketplace, cutting costs, mergers, reorganizations, and survival. The industry must find a way to ensure that all of this restructuring activity does not interfere with the more immediate concerns of timely Y2K remediation.

OIL & GAS UTILITIES

This sector covers both oil products and natural gas, however, the Committee's hearing focused primarily on natural gas as the principle source of residential heating. Oil provides about 40 percent of the energy Americans consume, including home heating. In addition, about 60 million American homes and businesses use natural gas for heating, cooking, and other applications.

Gas and oil utilities face a variety of Y2K problems in their administrative systems, as well as the microprocessors or computer chips embedded in the production, transportation and distribution systems used in this industry. Survey results published by the Federal Energy Regulatory Commission (FERC) in September 1998 show that this industry, like many others, started its Y2K efforts late.

According to the survey, most of the critical systems in this industry are still in the inventory and assessment phase, leaving little time for the more difficult phases of Y2K remediation and testing. As a result, the industry is not likely to complete repairs of all of its system in time, which in turn means that possible disruptions in the production, transportation, and distribution of gas and oil are possible.

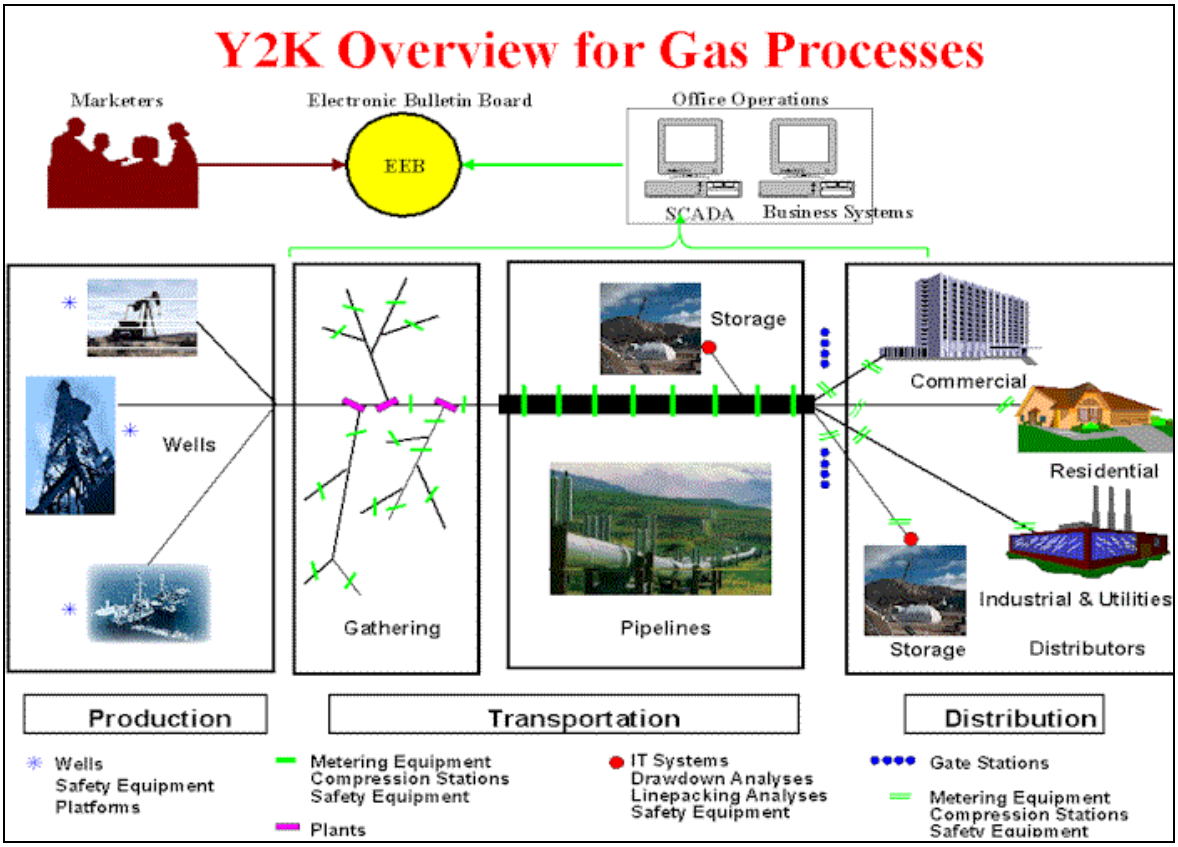

Figure 5

Automation and, thus, Y2K concerns are prevalent throughout both the gas and oil industries. As depicted in figure 5, FERC published a generic diagram that maps out the elements of gas and oil production, transmission, and distribution that must be checked for Y2K problems.

Note: This year, the Committee plans to increase attention to the oil industry, particularly the international Y2K implications on oil imports. The U.S. gets nearly 50 percent of its oil from imports, and several key oil producing countries are behind in their Y2K remediation efforts. If these countries are unable to sustain the level of imports because of Y2K failures in the pumping, refining, or transportation of crude oil, the implications on the price of gasoline may be significant.

Overview

Nearly all Americans rely on oil and gas in their everyday lives. Oil provides about 40 percent of the energy Americans consume. Besides the obvious gasoline, diesel fuel, and home heating oil, petroleum products are used in everything from toothpaste to raincoats. A barrel of crude oil (42 gallons) is refined into

Product	Gallons*
Gasoline	19.5
Fuel oil	9.2
Jet fuel	4.1
Residual fuel	2.3
Liquefied gas	1.9
Still gas	1.9
Coke	1.8
Asphalt	1.3
Petrochemicals	1.2
Lubricants	0.5
Kerosene	0.2
Other	0.3

*Totals more than 42 gallons due to processing gains.

Almost 60 million American homes and businesses use natural gas for heating, hot water, cooking and other applications. Natural gas comes through a 1.3 million-mile underground system. The U.S. has about 58,000 miles of gathering lines in the gas production areas, 260,000 miles of long-distance pipelines, and nearly 1 million miles of distribution lines operated by local gas utilities that must all be checked for Y2K problems.

Thousands of embedded systems in millions of miles of pipelines all must be checked and, if necessary, replaced. Vulnerable systems include distributed control systems, programmable logic controllers, digital recorders, control stations, recorders, meters, meter reading and calibration software, and SCADA. PC-based applications such as control and work management software within a utility may also possess Y2K vulnerability. Any date-dependent application, system or component may experience problems that result in complete system or station shutdown.

The President's Council on Year 2000 Conversion assigned FERC responsibility for the gas and oil sector. Other federal agencies involved in this sector include the Department of Energy, the De-

partment of Transportation (pipelines are a form of interstate transportation), the Department of the Interior, and the General Services Administration.

Trade associations representing the various gas and oil entities are also playing a key role in Y2K remediation efforts for this industry.[1]

Major Initiatives

The Committee's energy utility hearing was held on June 12, 1998. As described in the previous section, both electric utilities and oil and gas utilities were addressed. Gas and oil witnesses included, the Honorable James Hoecker, Chairman, FERC, Mr. James Rubright, Executive Vice President, Sonat, Inc. representing INGAA, and Gary Gardner, Chief Information Officer, AGA, and Lou Marcoccia, energy industry consultant.

The hearing better defined the Y2K problem in the gas and oil sector, heightened awareness, and mobilized an industry that was not yet fully engaged in addressing the Y2K problem.

In his testimony, Mr. Hoecker indicated that the Y2K status of the gas and oil industry is essentially unknown. He was especially concerned about small and medium sized companies and focused on the need for the gas and oil industry to share Y2K testing and compliance information. He indicated that Y2K readiness information might be difficult to obtain because of fear that the information may be commercially sensitive, that certain liability issues may arise, or that collaboration on this problem may expose companies to anti-trust actions.

The Committee was key to passing Y2K information disclosure legislation and obtaining clarification from the Justice Department to exempt Y2K information exchange from anti-trust laws. Mr. Hoecker also suggested that a Y2K database be established. API has since set up such a database.

Mr. Rubright, representing the interstate gas pipeline companies, highlighted the extensive use of embedded chips in the computerized devices instrumental to the operation and monitoring of gas and oil pipelines. According to him, most pipeline companies contend they will be Y2K ready by October 1999, but are concerned over both upstream and downstream suppliers, as well as utilities and telecommunications providers on which they rely. He also expressed concern over litigation risks, the large number of congressional electronic commerce initiatives, and anti-trust issues.

[1] The American Petroleum Institute (API), the Natural Gas Council (NGC), the American Gas Association (AGA), the American Public Gas Association (APGA), the Gas Research Institute (GRI), the Interstate Natural Gas Association of American (INGAA), the Independent Petroleum Association of America (IPAA), the Association of Oil Pipelines (AOPL), the Gas Processors Association (GPA), the National Gas Supply Association (NGSA), the Gas Industries Standards Board (GISB), the National Petroleum & Refiners Association (NPRA), the National Propane Gas Association (NPGA), the Petroleum Marketers Association of America (PMAA), and the Petroleum Technology Transfer Council (PTTC).

Mr. Gardner, representing gas utilities, focused on the complexity of gas distribution systems. He indicated that a gas utility will typically have between 50 and 100 systems with embedded processing located in such areas as storage fields, gas control and management operations, metering and facilities, and SCADA systems. His industry's experience suggests that the process of identifying, replacing or upgrading, and testing takes 12 to 18 months to complete.

The Committee's hearing was instrumental in motivating the President's Council on Y2K Conversion to create an oil and gas working group. The kick-off meeting for the oil and gas group was held at FERC in June 1998.

FERC has held subsequent meetings on July 14, 1998, September 3, 1998, and November 13, 1998. Minutes of the Oil and Gas Working Group meetings and other proceedings and events are publicly available on FERC's website.

API, a national trade association representing all phases of the oil and gas industry, provides direct assistance to FERC in managing the working group. In 1997, the API formed a Year 2000 Task Force to facilitate Y2K readiness across the petroleum industry. The API Year 2000 Task Force currently represents over 50 industry companies and meets every 6 to 7 weeks.

One of API's primary functions is to alert and educate industry members about the potential impact of Y2K on information, process control, automation and instrumentation systems, as well as concerns about other companies in the supply chain. API has also created a database to allow companies to share information about the readiness status of computer software and hardware, telecommunications networks, process control and electrical equipment, and embedded systems used by the petroleum industry.

AGA, a trade association of almost 300 natural gas transmission, distribution, gathering and marketing companies, and 181 local natural gas utilities that deliver gas to 54 million homes and businesses, has also been actively involved in Y2K. AGA members account for more than 90 percent of natural gas delivered in the United States.

AGA sponsors business television series, joint information technology conferences, and other forums to inform its membership of Y2K solutions.

Assessment

The Committee's survey, depicted in figure 3, included both electric and gas and oil utility companies. Concerns resulting from the survey expressed in the electric utility section of this report also apply to the gas and oil utilities. Progress is slow progress, assertions that they will complete Y2K remediation efforts in time are overly optimistic, the industry lacks knowledge about suppliers' Y2K status, and contingency planning is deficient.

The Committee's survey, although limited in scope, was the only available survey at the time. Since then, FERC released its first overall assessment of the Y2K status and preparedness of the gas and oil industry on September 18, 1998. AGA in coordination with the Gas Research Institute and the Interstate Natural Gas Association of America collected and analyzed surveys of its members to assess the industry's compliance with Y2K requirements. These surveys form the basis for the FERC assessment. Assessment results are depicted in figure 6 for business systems and figure 7 for embedded systems.

The survey was sent to over 8,000 gas and oil companies. Only 638 or less than 10% responded. Although the response was disappointing, it did represent 45% of oil and gas production, 78% of refining capacity, 70% of crude and product pipeline deliveries, and 43% of U.S. service stations.

The survey asked companies to indicate the stage their companies were in for business systems and for embedded systems. This required companies to summarize information at too high a level to be meaningful. In reality, a company may have hundreds or even thousands of business and embedded systems each at a different stage of remediation. Nevertheless, the survey results are still alarming. The survey indicates that 45% of companies who responded consider themselves to be in the assessment phase or earlier for business systems, and 60% for embedded systems.

The Committee can only conclude that, despite claims to the contrary, many companies in the gas and oil

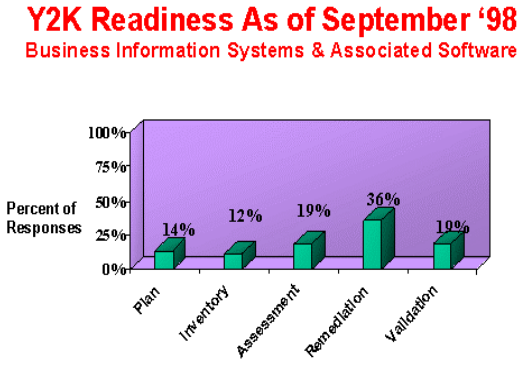

Figure 6

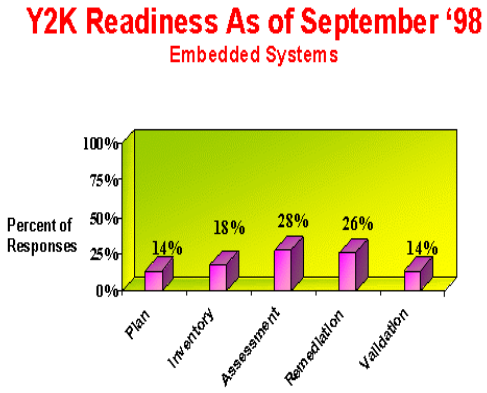

Figure 7

industry will not complete Y2K remediation efforts in time. This conclusion is based on the fact that only companies with the most robust programs typically respond to Y2K surveys. Y2K consultants estimate that remediation and testing are the most difficult phases, often consuming up to 40 to 70% of the entire Y2K effort.

Survey respondents all contend that they will be Y2K ready in time—76% by June 1999 and the remaining 24% by December 1999. However, based on the progress to date, and

the experience regarding the amount of time and resources it takes to complete the remaining phases, this contention may be unrealistic. The Committee recommends that the companies who are lagging this far behind, i.e., are still in the assessment phase or earlier, devote significant resources to contingency planning because they will not have sufficient time to repair and test all of their mission critical systems in the limited time remaining.

One of the biggest areas of concern for the Committee is the Y2K status of countries from which the U.S. imports oil. Nearly 50% of the oil used in the U.S. comes from foreign sources. Yet, as depicted in figure 8, many of the countries are significantly behind the U.S., and thus, have a high risk of failure. Indeed, 3 of the top 5 countries from which the U.S. imports oil are, according to the Gartner Group, 12 to 18 months behind the U.S. in their Y2K remediation efforts. This means that oil production and transportation may be at risk in these countries. Any disruption to oil imports could significantly impact oil availability and, thus, prices in the U.S. The oil industry and the federal government need to monitor this situation closely.

Country	Percent U.S. Imports	Y2K Status (Months Behind U.S.)	Risk of Disruption
Venezuela	16.2	12-18	High
Canada	15.5	0-3	Low
Saudi Arabia	14.4	12-18	High
Mexico	12.9	12	Medium
Nigeria	7.3	12-18	High
Angola	4.2	Unknown	?
Colombia	3.0	12-18	High
Algeria	2.9	Unknown	?
Kuwait	2.9	12-18	High
Virgin Islands	2.9	Unknown	?
Norway	2.3	12	Medium
Iraq	2.2	Unknown	?
Gabon	2.0	Unknown	?
United Kingdom	2.0	0-3	Low
Ecuador	0.9	12-18	High
Argentina	0.9	12-18	High
All Others	7.5	Unknown	?

Figure 8: Imported Oil Country Y2K Status

Concerns

- Y2K remediation in the gas and oil sector began too late and is progressing too slowly. The thousands of miles of pipeline that must be checked and repaired and the proliferation of embedded chips and processors throughout the industry's production, transportation, and distribution systems make failure of at least some mission-critical systems possible. The industry needs to step up its efforts and focus on developing contingency plans.

- The dependence of the gas and oil industry on other sectors—electric power and telecommunications—dictates better coordination with these sectors.

- While the large gas and oil companies are spending large amounts of money on Y2K remediation, the Committee is concerned about some of the smaller and medium-sized companies in this industry, including those up and down the supply chain. These small companies could be the linchpins for the

overall success of this industry.

- A Y2K assessment of oil producing countries is needed to determine the likelihood that U.S. oil imports will be disrupted, and, if so, what contingency planning will be needed.

WATER UTILITIES

Overview

Water:

There are approximately 200,000 public water systems (PWSs) regulated under the Safe Drinking Water Act that serve 243 million people in the United States. The remaining population obtains their drinking water from private wells.

PWSs are defined as community water systems, non-transient, non-community, or transient systems. Approximately 60,000 of the 200,000 public water systems are classified as community water systems. A community water system provides water to the same population year round. There are 3,687 community water systems in the U.S., which serve a population of 10,000 or more, and provide water to a total of 204 million people.

Approximately 75 percent of the American public is served by large community water systems covering populations of 100,000 or more.

There are over 30 community water systems serving populations in excess of one million people.

Although the community water systems collectively serve a large number of people, most community water systems serve less than 3,300 people. Many of those systems are privately owned and operated.

A transient non-community water system serves transitory customers in non-residential areas such as campgrounds, motels, and gas stations. Approximately 57 percent of public water systems are transient non-community systems. (Sources: EPA Report to Congress, EPA-810-R-93-1. September 1991, and AWWA/AMWA/NAAW 1998 Survey.)

Wastewater:

Seventy-two percent of the U.S. population (190 million people) is served by centralized wastewater treatment facilities; the remainder is served by on-site systems (e.g., septic systems).

There are 16,000 wastewater treatment facilities nationwide, with operations ranging from less than 100,000 gallons per day (about 1/3 of the total number of facilities) to systems that treat over 100 million gallons per day (less than 1% of the systems).

Systems such as Prince William County, Virginia, and Independence, Missouri, treat approximately 10 million gallons of sewage a day, while the largest systems, such as

those of New York or Chicago, treat approximately 1.5 billion gallons of sewage per day.

Nationwide, approximately 42 billion gallons of sewage are treated per day.

About 31% of the U.S. population is served by facilities that provide secondary treatment of waste and another 31% is served by facilities that provide better than secondary. Fifty percent of the design capacity of existing treatment plants allows for better than secondary treatment.

The remaining population is served either by plants that have no discharge or by individual on-site disposal systems.

Municipal governments own 95% of wastewater treatment facilities, either as part of a local government's public works department, or as a separate authority or utility district.

Typically, in small to medium-sized cities, the water utility and wastewater treatment systems are operated jointly. In larger cities they are usually separate operations.[2]

Major Initiatives

The Committee assessed the Y2K vulnerability of the water and wastewater, and took steps to increase awareness about Y2K issues in this vital sector of service. These include staff networking with the major water and wastewater industry association groups and the Environmental Protection Agency (EPA). The Committee also interviewed numerous industry experts, surveyed water and wastewater company Y2K preparedness, and monitored other industry surveys recently administered by the major water and wastewater industry associations.

The Committee staff has also participated with the EPA in tours of five local Washington, D.C. area water and wastewater treatment plants and worked with the major water and wastewater industry associations. These include

- the Association of Metropolitan Water Agencies (AMWA),
- the National Association of Water Companies (NAWC),
- the American Water Works Association (AWWA),
- the Water Equipment Manufacturers Association (WEMA), and
- the Association of Metropolitan Sewerage Agencies (AMSA).

On December 18, 1998, the Committee held a field hearing on Y2K preparedness in the water and wastewater industry in Anaheim, California. The City of Anaheim Public Utilities Department hosted this hearing. The witnesses were Dana Minerva, EPA Deputy Assistant Administrator for Water; James Brainerd, Chief Information Officer, Los Angeles Department of Water and Power; James Ellisor, Director of Information Systems, Las Vegas Water District; Patrick Miles Information Technology Director, Orange County Sanitation District; William Hetland, District Manager, El do-

[2] Congressional Research Service Briefing to Committee Staff on 06/02/98

rado Irrigation District; and James Bell, Vice President; Technical Services, Smith and Loveless, Inc., (a leading manufacturer of water and wastewater and pumping equipment). Following the hearing, Senator Bennett toured the City of Anaheim Water Services Lenain Water Filtration Plant.

One of the major topics of discussion during the hearing was the need for water and wastewater companies to obtain assurances from their electric power providers that they will be considered "uninterruptable" or priority customers in the event power supply problems occur. Currently, no legal authority exists to require that power utility companies consider water and wastewater companies as priority customers. Such agreements have customarily been negotiated on a case-by-case basis between power and utility companies.

Mr. Jim Ellisor, Director of Information Systems for the Las Vegas Valley Water District, noted in his testimony that some variability exists in water systems' reliance on electricity, depending on system design. He noted that some systems rely completely on gravity and require little or no electricity for their operation, including some large systems.

During her testimony, EPA Deputy Assistant Administrator Dana Minerva noted that the EPA does not consider reliance on switching to the manual mode of operation as the preferred solution to Y2K problems. Manpower limitations were cited during the testimony as one impediment to a company's ability to easily switch to the manual mode of operation. The possibility of creating some type of "reserve force" that could assist companies in need of additional personnel in the event of the need to default to manual mode was discussed. It was concluded that operation of water and wastewater plants in the manual mode requires skilled and certified operators. Consequently, a pool of unskilled reservists from outside of the water industry would probably not provide an effective solution to the manpower shortage problem.

It should also be noted that each water and wastewater treatment system requires operators to possess a body of knowledge specific to those individual systems. Mr. Bill Hetland, General Manager of the El Dorado Irrigation District, stated that most agencies would have to look to their own internal resources to solve the Y2K problem, that it would be unrealistic to think that a pool of labor would be available to assist in Y2K. He also stated that staffing would become an issue for his agency if manual operations were required for an extended period of time.

Mr. Hetland stressed the importance of providing information to the community about the problem. He also described the progress his agency had made and said such information is vital to community preparedness. He also expressed concern about regulatory compliance and the liability issue.

Deputy Assistant Administrator Minerva testified about EPA's implementation of a new policy aimed at encouraging Y2K testing in the water and wastewater industry. This policy waives penalties if violations occur during Y2K testing, provided specific conditions are met. Deputy Assistant Administrator Minerva further stated that testing and preparation would be taken into account if Y2K-related enforcement violations occur on January 1, 2000 or other "problem dates." According to Ms. Minerva, EPA cannot rule out any enforcement pertaining to Y2K problems, however it will take efforts to resolve the problem into account.

The new EPA policy is limited to testing-related violations disclosed to EPA by February 1, 2000. The policy is subject to conditions which include the need to design and conduct the tests well in advance of the dates in question and to correct any testing-related violations immediately to ensure the protection of human health and the environment.

The General Accounting Office, at the request of this Committee, is currently preparing a survey of state regulatory agencies with jurisdiction over public water and wastewater utility companies. This survey will determine the extent to which state regulatory agencies are assessing the Y2K readiness of public water and wastewater utilities.

In July 1998, Committee staff surveyed 20 water and 20 wastewater companies regarding their Y2K preparedness. About 25% of those contacted responded to the survey, despite the fact that a confidentiality pledge was made to all survey recipients. The results indicate that of the 11 companies that responded to the survey, slightly over 25% stated that it was unlikely they would be Y2K compliant by January 1, 2000. More than 50% of the respondents had not yet completed the initial assessment phase, and 36% did not have contingency plans in place. Of the 64% that had contingency plans in place, the contingency consisted of either switching to manual operations or utilizing parent company operations. The table at the end of this section displays the results of the Committee's survey.

In July and August 1998, the American Water Works Association (AWWA), the Association of Metropolitan Water Agencies (AMWA), and the National Association of Water Companies conducted a joint survey of their memberships regarding Y2K readiness. Approximately 725 of the 4000 members of these associations responded to this survey.

- About 81% of the respondents expect to complete their internal Y2K work on time.

- About 89% of the community public water systems serving populations ranging from 100,000 to 1 million people expect to have Y2K compliance work completed on time.

- About 87% of the systems serving between 10,001 and 100,000 people expect to complete their work on time.

- About 76% of the systems serving less than 10,000 people expect to be completed on time.

- Only 26% of the respondents reported having fully assessed the compliance status of vital business partners such as power and telecommunications service providers and vendors upon whom they rely.

- About 83% of the respondents reported that they had not completed their Y2K contingency plans.

- About 39% of the respondents reported that they expect to spend less than $10,000 on their Y2K programs.

- About 26% expect to spend $10,000 to $50,000 on their programs.

- About 80% expect to spend $50,000 to $100,000.

- About 10% expect to spend $100,000 to $1 million.

- About 4% expect to spend over $1 million.

In June 1998, the Association of Metropolitan Sewerage Agencies (AMSA) conducted a survey of its 202 members. AMSA is a coalition of publicly owned wastewater treatment agencies. Its member agencies are responsible for collectively treating and reclaiming over 18 billion gallons of wastewater each day. AMSA received 76 responses to its survey. Results indicated the following:

- The level of automation within each agency averaged 54%. (Not all aspects of each agency's operation are automated, i.e., an agency may utilize automated billing but its operational plant processes may be manually controlled.)

Eighty-eight percent of the respondents reported that they currently utilized some form of Supervisory Control and Data Acquisition System (SCADA) in their operations. It should be noted that while an agency might use SCADA in one aspect of its operation, such as monitoring a remote pumping station, this does not mean that its entire system is automated. These systems are pervasive in the power and water and wastewater utility industries and typically collect and transmit data about flow, pressure, and temperature. Computers can be utilized at any point in the system where measurements are made regarding pressure, water quality, chemical content, treatment, time, or billing.

- Nearly 100% of the respondents reported that they use computers for process control, laboratory research, industrial compliance, billing systems, and other administrative purpose, such as finances, inventory, and maintenance management.

- Ninety percent of the respondents have developed a plan to

assess and address the Y2K issue.

- Forty-five percent of the respondents reported estimated Y2K costs ranging from $0 to $100,000. Fifteen percent reported estimated costs in excess of $1 million, with two respondents reporting estimates of $15 million. Most of the agencies reporting costs in excess of $1 million were relatively large systems, but 17 % of those reporting costs in excess of $1 million were agencies which served under 250,000 people. Most agencies estimated Y2K costs between 0 and 2 percent of their operating costs.

- Approximately 95% of the respondents reported they had begun to implement Y2K solutions, and 26% reported they were complete or nearly complete in their Y2K preparation.

- Approximately 55% of the respondents reported having a backup plan should all or a portion of their systems fail as a result of Y2K.

Concerns

With very few exceptions, the ability of the water utilities to supply fresh, clean drinking water and to effectively treat wastewater is linked directly to the utilities' ability to obtain a continuous and reliable source of electric power. This fact underscores the importance of the topic of this Committee's hearing on June 12, regarding the Y2K problem and electric power utilities.

While some water and wastewater utilities can generate their own electricity in the event of a power outage, the ability to do so for an extended period of time would depend upon the availability of a steady supply of diesel or other alternative fuel to power the utilities' independent generators. In general, the larger water and wastewater utilities do maintain the ability to generate their own source of back-up electricity, but the duration for which this can be done varies widely within the industry.

There is no interconnectivity built into the water distribution system as with the electric power grid. Nevertheless, some citizens could be facing interruptions of water utility service on January 1, 2000 if water utility companies do not adequately address the Y2K problem.

Water industry Y2K issues are broader and more complex than simply whether electric power will be available to run the pumping stations. For example, wastewater treatment facilities and water supply utilities are interrelated. Upstream contamination caused by a malfunctioning wastewater treatment plant would have a direct impact on a fresh water treatment facility located downstream.

The EPA identified six major areas in water and wastewater treatment facilities where embedded computer chips might be located. These are communications infrastructure, instrumentation, facilities and sup-

port, materials tracking, production and process, and process controls. The list included 51 individual devices that potentially could contain embedded chip technology.

Of primary concern in the water and wastewater industry is the vulnerability of sensitive SCADA systems utilized in automated water and wastewater processes

The degree of automation in water and wastewater systems varies widely throughout the country, depending upon both the age and size of the individual systems. Many older systems are not highly computer dependent.

The Committee is concerned about the inability of some wastewater treatment facilities to properly operate in the event of power outages of even moderate duration. Committee staff reviewed numerous cases in which electrical power interruptions led to the discharge of untreated wastewater or raw sewage into rivers or the ocean. Such discharges currently occur on a sporadic basis throughout the country due to power outages and excessive rainfall.

As is true in all other aspects of the Y2K problem, the water and wastewater industry is also vulnerable to supply chain interruptions. Water treatment plants in particular rely on a regular supply of chlorine and other chemicals that are required in the water treatment process. Long-term interruptions in the means of production or delivery of these items due to other Y2K problems would directly impact the utilities' ability to deliver their services. The stockpiling of some of these chemicals prior to the Year 2000 has been proposed by some as a means of alleviating concerns about supply chain interruptions. However, some of the chemicals used in the industry represent a public health hazard if accidentally discharged into the environment. The risk to public safety would be greatly multiplied if some of these chemicals were stockpiled.

Committee staff has reviewed numerous recent examples of computer-related or computer-induced failures in the water and wastewater industry. While the cases reviewed are not believed to be the result of Y2K induced problems, they clearly illustrate the sensitive and important role which computers play in the water and wastewater services area. Numerous water or wastewater companies could be confronted by similar computer-related failures on January 1, 2000, if proper steps are not taken now to address the Y2K issue.

Numerous representatives of the water and wastewater industry offered assurances to Committee staff that they could switch their operations to the manual mode in the event of a Y2K disruption. In their response to the AMSA survey, most wastewater agencies pointed out that switching to the manual mode would present little if any problems since many automated processes run in parallel with manual instrumentation and control. Switching to the manual mode of operation may represent a viable alternative to computer-controlled processes

under ideal conditions and in a controlled environment. However, the conditions that might require transition to a manual mode of operation are likely to be neither controlled nor ideal in the case of Y2K.

On its face the survey data cited here appear to present a somewhat optimistic picture of the Y2K readiness of the water and wastewater industry. However, attention must be paid to the fact that the response rate for each of these surveys was relatively low, and the status of those agencies that did not respond remains largely unknown.

Analysis of the July 1998 joint AMWA/NAWC/AWWA July 1998 survey of water agencies reveals that 14% of responding companies serving populations over 100,000 people reported that they would not have their Y2K compliance work done on time. The exact impact that this will have on their operations is not clear, as it is unknown whether this includes any of their mission-critical systems. Of the 11 companies who responded to the Committee's survey, over 25% indicated that they did not expect to be Y2K compliant by January 1, 2000.

Water Utility Sector Survey Conducted by Special Committee Staff

Company Type	Date Aware of Y2K Problems	Date Formal Project Started	Is Your Assessment Complete	Percent Systems Mission Critical	Contacted Service Providers/ Vendors	Legal or Liability Concerns	Contingency Plans Complete	Contacted by Regulators	Contacted by Investors	Will You Finish In Time
1 water	1996	1996	80%	50%	Y	Y	Y	Y	Y	Y
2 water	1997	1997	N	90%	N	N	Y	Y	Y	Y
3 water	1997	1997	Y	50%	N	Y	Y	N	Y	Y
4 water	1996	1998	N	unknown	N	Y	N	Y	Y	N
5 water	1996	1998	N	unknown	N	N	N	Y	Y	unknown
6 waste water	1995	1996	Y	0%	N	N	Y	Y	N	Y
7 water/waste	1996	1997	Y	20%	Y	N	Y	N	Y	Y
8 water/waste	1996	1997	Y	100%	Y	Y	Y	N	Y	Y
9 water/waste	NR	NR	NR	NR	NR	NR	NR	NR	NR	Y
10 water/waste	1996	1996	N	unknown	Y	N	N	Y	N	Y
11 water/waste	1996	1996	Y	90%	Y	N	Y	Y	Y	N

Notes:

* MC = mission critical, NR = no reply.

- Only 27.5% of all water and wastewater companies surveyed responded.
- The 8 companies that reported their costs, project that they will spend over $86 million collectively on Y2K.
- Of the 11 companies who responded, 27% reported they would probably not be Y2K compliant.
- More than 50% of the 11 respondents have not finished their companies' initial assessment of compliant.
- Of the 11 water and wastewater companies, 36% do not have contingency plans in place. The 64% who do intend to either use their parent company's system or operate manually.