HOW BAD A BUG?
APPROACHING Y2K'S ELEVENTH HOUR

A hope and a prayer always helps in cases like this. But then the world has never quite faced a case like this...

The Year 2000 (Y2K) computer problem, or "millennium bug" as the programming mistake is popularly called, is challenging global cooperation in new ways.

If not corrected, the transition into the 21st century will be anything but smooth, as faulty computers calculate the change of date as 1900 instead of 2000. Will cities suffer electricity blackouts when computers fail? Will banking transactions work? Will telecommunication links break down? What could happen at hospitals? The "what if?" questions are everywhere.

"The problem is huge," Peter de Jager, the Canadian who first widely warned the world about the bug in 1993, has noted. "Counting the number of problems is like counting the granules in a bucket of sand." Fortunately, the countdown began years ago in highly computerized countries, and de Jager and many other experts now do not expect a global catastrophe at the turn of the century.

Yet they do see trouble ahead. In many countries, Y2K assessments and readiness plans were started late for a number of reasons, and in some of them, too late to meet the bug's non-negotiable deadlines. *(See box, page 11.)* Given the world's interdependence, the situation threatens disruption beyond national borders -- making international cooperation imperative to limit damage.

Over recent months, the United Nations, IAEA, and other international bodies have redoubled efforts to raise governmental and public awareness about Y2K issues, and to exchange more information and experience to head off problems and help countries set up contingency plans. Actions included:

- In late June 1999, more than 170 countries sent delegates to the United Nations in New York for the Second National Y2K Coordinators Meeting. On the agenda were follow-up actions to the UN's first Y2K meeting in December 1998. Experts presented assessments from national, regional, and international perspectives.

Summing up the sessions, Pakistan Ambassador Ahmad Kamal, who chaired the meeting, reported that some Y2K problems are likely to go unsolved by New Year's Eve.

"The participants agreed that it might not be possible to fully achieve the goal of Y2K compliance by the target date of 31 December 1999," he reported. "Member States were urged to establish contingency plans for all systems and activities of national importance to handle potential Y2K-related disruptions." He further reported that delegates "strongly underscored" the need for even greater bilateral and multilateral support for national, regional, and global Y2K efforts.

In particular, delegates agreed more work was needed to address the specific needs of many developing countries. Among planned actions are steps to facilitate cooperation between the private sectors of developed and developing countries, as well as countries with economies in transition, to promote the flow of technical know-how in finding timely solutions to the Y2K problem, and to promote the active participation of international organizations in national efforts for dealing with emergency situations arising from Y2K-related

TRACKING THE BUG ON THE WEB

Part of the virtual reality of the Y2K computer problem is that one of the best ways to track information about it is through your computer. To be safe, just don't wait until New Year's Eve to do it.

One top source of information on the Internet is www.year2000.com, the site of Peter de Jager, the Canadian who popularized the problem in the early 1990s. Though he wasn't the first to identify the millennium bug, he knew how to explain it so the world could take notice -- "Doomsday 2000" was the title of de Jager's 1993 article in *Computer World* that warned the world it was undeniably "accelerating toward disaster".

Today his Web pages receive more than half a million visitors a month, and millions more visit hundreds of other Y2K sites detailing the problem for governments, industries, and people with personal computers.

Among those sites is the IAEA's *WorldAtom.* Its Y2K Web pages *(www.iaea.org/worldatom/program/y2k)* opened in February 1999 to report on the Agency's activities and plans. The IAEA is serving as a clearinghouse and contact point at the request of its Member States on the Year 2000 problem as it concerns nuclear and related technologies and computer services. The pages were developed by the IAEA Division of Public Information to coordinate the global exchange of information on the Agency's Y2K activities and related topics.

The site is designed as a one-stop directory for information about Y2K activities carried out in the Agency, its Member States, and international organizations within and outside the UN system. It covers four broad categories: documents and reports; information about IAEA activities related to nuclear safety, radioactive waste management, medical facilities, safeguards; and internal computer systems; current news and viewpoints of experts; and links to other Y2K Internet information resources, including sites in more than 20 Member States. A number of IAEA documents are electronically available over the site, including the Agency's Y2K Action Plan, a technical guidance document on nuclear safety for achieving Y2K readiness; and technical documents related to radioactive waste management facilities, medical facilities that use radiation generators and radioactive materials, nuclear fuel cycle facilities, and electricity grid performance.

An interactive feature of the Agency's Y2K pages is an on-line discussion forum through which interested scientists, governmental officials, journalists, and other members of the public can exchange information by electronic mail. More than 100 participants have registered to use the news group, including energy journalists and government and industry officials.

disruptions. *(See the World Bank article beginning on page 12, and the UN's Y2K Internet site at www.un.org/members/y2k for fuller information.)*

■ In May and June 1999, the Group of Eight leaders from the United Kingdom, Canada, France, Germany, Italy, Japan, Russia, and the United States initiated moves to raise awareness of the millennium bug, and the importance of contingency planning. One area of G-8 interest is the bug's potential impact on energy and electricity production, including the safety of nuclear power plants in Eastern Europe.

■ In June and July 1999, the IAEA stepped up its efforts to help governments -- who bear the prime responsibility for Y2K-readiness programmes — to assess the problem, and to put into place remedies and contingency plans. The Agency's particular focus is on civilian nuclear facilities, and it is serving as a Y2K information clearinghouse and contact point at the request of its Member States, including dissemination of information over the Internet. *(See box, page 9.)*

The thrust of recent activities has been to broaden the exchange of Y2K experience and cooperation among Agency Member States in various fields. Safety-related missions were sent to nuclear plants in more countries of Eastern Europe and other regions.

Additionally, three international workshops were convened to bring together experts from various fields. In late June, the IAEA and World Health Organization organized an international workshop focusing on medical facilities using radiation technologies. Another workshop, in early July, targeted facilities for radioactive waste management and the nuclear fuel cycle. The third workshop addressed Y2K contingency planning and other issues at different types of nuclear reactors. A fourth workshop, addressing issues related to electricity networks, is planned for mid-September in Vienna.

Feature articles in this edition of the *IAEA Bulletin* report on the range of Agency initiatives. Reports highlight actions in areas of nuclear safety, safeguards and physical protection of nuclear material, radioactive waste management, medical facilities, nuclear fuel cycle facilities, nuclear power performance, and the Agency's own computer systems and operations.

How might the millennium bug affect programmes and computer systems at facilities applying nuclear and radiation technologies? Some insight can be gained by reviewing what the problem is all about.

A GAME OF NUMBERS

The problem is rooted in the early days of electronic computing, as the European Commission noted several years ago: "In order to save on what used to be expensive magnetic storage, only two digits have been used in many cases to represent the year in date fields. As a result, in many applications the year 2000 will be interpreted as the year 1900 causing failures in arithmetic computations and data processing. Complicating the picture is the fact that the Year 2000 is a leap year, which many computer programs will miss.

The turn of the century is the date when most problems are likely to occur. However, several systems are already beginning to fail when processing future dates, and others will not show failures until later in the year 2000."

It's not an issue without some precedent, as experts at the Mitre Corporation in the United States have pointed out. Few realized, for example, that the IBM 360 could not handle dates past 31 December 1969 until the computers all over Europe started failing at midnight local time on that date. As the failures progressed around the globe, following the timezones, IBM identified the problem and was able to provide its American and Asian customers with a temporary fix by telling them to lie to their computers about the date. Meanwhile, IBM proceeded to create a longer-term patch for the problem.

Unfortunately, this time around, experts say the problem is not isolated to programming errors caused by the use of the two-digit year coding scheme. The year 2000 presents a "triple witching hour" of potential traps for designers and coders. In addition to the two-digit year coding, there are distinct issues surrounding the use of the six-digit date representation, and still other risks caused by the calculation of the leap year. And just to make matters worse, 1 January 2000 falls on a Saturday. Problems caused by coding errors may not be discovered until the next regular working day, allowing enough time for errors to inflict a great deal of damage.

Y2K DATELINE

■ **22 August 1999.** Systems that interface with the Global Positioning System (GPS) could have problems; these include systems for the transport of nuclear fuel where knowledge of location is important.

■ **9 September 1999.** Problems could arise for computer-based systems that handle the year with only two digits and that use the number 99 (or 9999) as an end-of-file marker or stop code.

■ **1 January 2000.** A key date for computer-based systems that handle the year with two digits and may misread 00 as they year 1900 instead of 2000.

■ **29 February 2000.** Problems could arise for computer-based systems that do not correctly identify the year 2000 as a leap year, risking failure on February's leap day.

■ **1 March 2000.** The day after February's leap day presents another problem for systems that do not correctly identify 2000 as a leap year.

■ **31 December 2000.** The 366th day of the year -- it poses another challenge for systems that do not identify 2000 as a leap year.

■ **1 January 2001.** Another hurdle for systems that missed the leap year.

HOW BAD?

Just as today's railroad uses a rail standard derived from the width of a Roman chariot, modern computer systems inherit their default conventions from the mainframe era, experts at the Mitre Corporation have noted. Back then, it was common practice to encode the year as a two-digit field. No one knows how many of the world's millions of personal computers and data processing systems are so genetically flawed.

The situation makes it hard to quantify the full dimensions of the Y2K problem, as delegates at the UN's June meeting noted. While there's no hard evidence to support doomsday predictions, neither can serious problems be ruled out.The threat runs deep because it's not just linked to computer information systems. Any system anywhere -- from elevators to traffic lights -- that uses computer chips stands at risk.

The Y2K problem also has peculiarities that make it more than a standard computer maintenance issue. First and foremost, it has a deadline that not only won't move but is common to everyone. Even after specific problems are identified, experts need to be found to test, validate, and activate solutions -- steps that eat the lion's share of costs and take time and expertise to put into place.

As the world closes in on Y2K's eleventh hour, estimates to find, fix, and manage Y2K problems are being revised upwards -- to more than $100 billion in the United States alone. Billions more are being sought or spent globally, as government and corporate officials talk of being in the final legs of a race to meet Y2K schedules and deadlines.

The closing months of 1999 should see a barrage of media reports and rumours about the millennium bug's far-ranging effects. Even Hollywood is reported to have some scary bug movies set for release.

At the UN meeting in June, governmental delegates were upbeat about the rising level of global cooperation. One big remaining concern is public perceptions of the problem, it was reported. Apart from the hardware and software issues, a major challenge facing countries is preparing citizens for possible Y2K disruptions without causing panic.

For many of us, Y2K has been just another fuzzy acronym in the news. That should change as the clock ticks ahead to the Year 2000. At press time, the Y2K countdown stood at just about 3900 hours, 52 minutes, and 36 seconds...35...34...33...

--Lothar Wedekind, Chief Editor for Periodicals and Electronic Information Services in the IAEA's Division of Public Information. More information about the IAEA and its programmes is available through the WorldAtom Internet site at www.iaea.org. ❑