

How Long Will a CD-R Last?

by Gordon Woolf*

How good are CD-R discs? How long will they last? Will they be readable in three months, three years, 30 years?

When I read several reports of CD-R discs not being readable a few months after they were written, I thought it time to find out more.

It seemed scary: warnings from seemingly reputable sources. A lot depends on how you treat the CDs and even more on the quality of your initial recording, but there are discs around which are more likely to fail than to work - one survey showed that six out of 10 discs can fail if you select the wrong brands.

As one CD duplication service states: "It is not advisable to leave a CD-R upside down in bright light or the sun for a long time" but most failed backups are not satisfactorily written in the first place. There are so many things which can go wrong with a recording that manufacturers of poor quality discs may get away with it for a long time.

If you can write well to a good CD, it will probably last. But we've probably all heard of companies happily backing up data to tape every night, and never checking they can actually read anything back.

Kodak say their accelerated aging tests indicate that their Infoguard CD-R, which has an extra coating over the recording surface, will last 200 years. TDK say that their discs will last "about 100 years".

Tests by West Deutsche Rundfunk in Germany support manufacturers' claims of two or three years ago giving 10-20 years as the life of a CD. Australia's National Film and Sound Archive also suggests a life expectancy of 10-20 years compared to pressed CDs lasting around four times that long.

John Spence, head of radio archives with the Australian Broadcasting Corporation in Sydney, has been quoted, along with many others, as holding the view that how long the CD-ROM format is going to last "is perhaps a more important question".

Jerome L. Hartke, of Media Sciences, Inc., has not tested longevity but the more simple matter of writing and reading. He reports: "The quality of CD-R discs from experienced manufacturers has improved from 30 per cent defective discs in 1998 to 13 per cent in 2000. Failures for other discs increased from 33 per cent in 1998 to an alarming 60 per cent in 2000."

In other words it seems that while the original manufacturers are getting better, there are an alarming number of questionable discs around. There's more information on this at <http://www.msscience.com/survey.html>.

The survey concluded: "Test results clearly indicated that all discs were not alike, even if their colors were similar. Cost pressures have resulted in a broad matrix of stampers, dyes, metallizations, and processes. No correlation was observed between CD-R quality and dye type (cyanine or phthalocyanine), metallization (gold or silver), or recording speed (2X-8X). Quality is primarily determined by efforts at the manufacturing facility."

Even so, many reports of extremely short life in discs could be due to them being recorded on faulty or substandard equipment rather than of being poor quality discs in the first place.

The US standards institute has a committee (ANSI Committee IT-9) which is working on guidelines for CD-ROM and CD-R life estimation. However, there seem to be no standards for drives, other than an expectation that they will work to the "Orange Book" specifications. So, the first question one has to ask is whether one is

getting a satisfactory disc in the first place, then whether you are making a good recording.

There are still many references on the Internet to a 1998 report in 'U.S. News and World Report' under the heading "Whoops, There Goes Another CD-ROM" that quoted the life of data recorded on CDs as about five years.

Laura Tanglely wrote that unlike paper based landmarks of the past, the essential records from today, including health and bank records and research data, would quickly disintegrate.

This has been denied by many in the industry. For example, Stephen F. Nathans in EMedia Professional, wrote under the heading "Can CDs Get Mad Cow Disease?" that while research by National Media Lab (NML) in the USA using "accelerated aging" had stated that CD-Rs from "all major vendors are acceptable for reliable data storage" for "at least five years", that "the best vendors" of CD-ROM media can be expected to provide reliable data storage for 50 years; CD-R's best and brightest clock in at 30 years, maybe more.

The reasons for differences in colour are explained in the sidebar above. But even expert writers and researchers in this field refer to a level of secrecy among the manufacturers which has only recently been breaking down.

While some Web sites include tables of who produces what brand, and what dye and metallic layer they are based on, there is no real way for the consumer to know just where a minor brand CD-R was made and using what dye. There are hints that even among the major manufacturers quality could vary somewhat according to which factory the disc was made in.

However, even if we stick to top brands, it is the standard of writing the disc today which is going to have the greatest influence on how long it will last. For example, this may be influenced more by the possibility that the writing laser is gradually losing power or accuracy.

Dana J. Parker, co-author of several technical books on CD-ROMs, is quoted online as stating:

"CD recordable technology is a complex and convoluted subject. There are many factors that come into play when recording a disc: the rate of spin, the formula of the dye, the ambient temperature, the internal temperature, the age of the media, the power and wavelength of the laser, the spacing and size of the marks on the media relative to the speed of the disc, to name but a very few."

At least you can discount the myth of "CD rot". It did have some truth with early compact discs - which use aluminium as the backing, and where, if the edge coating was incomplete, the aluminum could corrode through oxidation (aluminium doesn't rust, but you will have seen that grey powdery coating on older aluminium windows which is the equivalent).

But there are some other problems. The silver coating used on some CD-R discs may also be affected by sulphur, a common pollutant of the air we breathe.

Gold may be best, but cost means that gold layers tend to be very thin, and so a thicker silver layer may be better than a thin gold layer. Again, our descendants may know the answer. Ask again in 90 years.

Early labelling inks managed to corrode the CD - and I'm sure I'm not the only person to have written to a CD, checked that all is well, and then grabbed the nearest marker to note the contents and by doing so created another coaster.

Water must also be avoided since polycarbonate will absorb water molecules and oil from fingerprints or organic vapors in the environment can also attack either surface. So where does this leave us? Somewhat confused. And we have not covered John Spence's greater concern that it may be as hard to find a CD player in 20 years time as it is now to find a Benoulli Box or an 8-inch floppy drive. To keep

the material you will also have to keep the hardware.

Those few of us who really need assured information retrieval should be considering commercial services who use top quality discs, expensive calibrated CD writers and clean rooms to ensure no dust or pollution problems in the writing stage. I will continue to use the cheapest bulk-buy discs for file transfers, and for progressive backups which I will dump in a week or a month's time. But for true backups, I'll go for the more expensive brands which at least make some reasonable claims at longevity.

Does Colour Matter?

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Unlike an ordinary CD, the CD-R has an organic dye recording layer between the polycarbonate substrate and the light reflective layer. The polycarbonate is etched, or stamped, with a spiral groove, usually called a "pre-groove", used to guide the laser beam. The laser beam heats and melts the organic dye forming a series of marks which resemble the pits of a pressed CD.

The colour of a recordable CD can be misleading because what you see is a combination of the colour of the dye, and of the metallic coating which reflects through it. The gold CD-R uses clear phthalocyanine dye and a gold reflection layer. The green CD-R uses cyanine, which is blue, but with the gold reflective layer, it appears green. Recently the cyanine formula has been altered to give a longer life and the gold reflection layer has also been replaced by a silver reflection layer, which makes the color appear blue.

Other blue media are made of azo pigments. The colour may seem similar to the more recent cyanine/silver combination but manufacturers claim these blue discs are as durable as golden ones.

Colour does not matter to the recorder. In the light range in which they work, all the colours will appear the same.

Phthalocyanine is less sensitive to ordinary light than cyanine but has a narrower range for writing with laser light. Most CD-R drives are based on using the original Taiyo Yuden cyanine system licenced by Taiyo Yuden to TDK and Ricoh, who in turn make discs for many other companies.

Phthalocyanine was developed by Mitsui Toatsu as an alternative to cyanine and licensed to Eastman Kodak and to Mitsubishi/Verbatim. All three companies may manufacture discs for resale by other companies.

Mitsubishi developed the metallised azo dye that, used with a silver reflective layer, provides an unmistakable blue color. Azo CD-R discs are also marketed by Verbatim.

More recently, third party dyes have appeared. These are not Taiyo Yuden cyanine or Mitsui Toatsu phthalocyanine dyes, although the colours may be similar.

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