

## Criteria for Defining Print Life

It is very important to know which degradation mechanism is the limiting mechanism in any given storage environment. It is also important to know the print-life criteria being used in reporting print life. The print-life criteria determine “how bad is bad”—for example, when a consumer would take a print down and throw it away.

Kodak uses the illustrative criteria stated in the ANSI/ISO standard, which places dye-fade limits at 30 percent.<sup>4,5</sup> Internal studies done by Kodak indicate that 30-percent fade is a conservative limit.

**Table 1** compares dye-fade limits, consumer descriptors, and consumers’ perceptions or reactions.<sup>6</sup>

**Table 1**

### Approximate Correlation of Color Descriptors to Dye Loss from 1.0 Density

Approximate Dye Loss	Correlated Visual Impact
0 to 10%	Minimal
10 to 15%	Very slight—noticeable to an expert only in a paired comparison
15 to 20%	Slight—noticeable in a paired comparison
20 to 30%	Moderate—noticeable in single stimulus to a person familiar with original scene quality
30 to 60%	Noticeable fade with a single stimulus, but not objectionable
Greater than 60%	Very noticeable fade with a single stimulus; possibly objectionable based on use

Depending on the scene content, fade levels below about 15 to 20 percent are usually not noticeable without direct comparison to an unfaded reference image. A fade level between 20 and 30 percent could be considered noticeable without a non-faded comparison, but typically would not be considered objectionable. **Fade levels between 30 and 60 percent would not be objectionable;** consumers would continue to value the image based on scene content and emotional involvement.

**Additional research continues to confirm that the use of the 30 percent endpoint criteria is quite conservative, and that levels of 60 percent or higher can still be considered to fall within the acceptable category. Generally, at fade levels above 70 percent, the psychophysical studies behind this research found that most prints would fall into the marginally unacceptable category or worse.<sup>7</sup>**

Although it would be possible to use a fade limit greater than 30 percent and report longer print life, Kodak takes a conservative approach with the 30-percent upper limit. It is also important to note that using a fade limit lower than 30 percent would result in under-predictions of print life. For example, a fade limit of 15 percent may be appropriate for images in a museum, but is far too conservative for typical consumer environments because a print at this endpoint would only be slightly changed from the original. **Using a 15% endpoint would predict print life that is only half of that predicted using a 30% criteria and would be very misleading. Many consumers would see little or no change in a single stimulus situation and calling this an endpoint could cause needless concern and worry.**

<sup>4</sup> *Stability of Color Photographic Images—Methods for Measuring*, ANSI IT9.9-1996, and ISO 10977.

<sup>5</sup> *Stability of Colour Photographic Images—Methods for Measuring*, ISO Publication 18909-2006.

<sup>6</sup> D. Oldfield and G. Pino, R. Segur, J. Twist, “Assessment of the Current Light-Fade End-Point Metrics Used in the Determination of Print Life: Part I”, *Journal of Imaging Science and Technology*, 48 (6), 2004, pp. 495-501.

<sup>7</sup> D. Oldfield and J. Twist, “Assessment of the Current Light-Fade Endpoint Metrics Used in the Determination of Print Life: Part II”, *Proceedings of IS&T’s 2004 Conference on Archiving*, pp. 36-42.