



By James E. Leemann, Ph.D.

Seen any Black Swans lately? Low-probability, high-impact events are impossible to predict

What do the invention of the wheel, Pompeii, World War I, the financial market crash of October 1987, the spread of the Internet, Google, the 2004 Indian Ocean tsunami, and September 11, 2001 share in common? In his 2007 *New York Times* best seller, “The Black Swan”, Nassim Nicholas Taleb uses them as examples of a Black Swan Event. Each:

- ▶ Was an *outlier*, existing outside the realm of regular expectations, because nothing in the past could convincingly point to their possibility.
- ▶ Carried an extreme impact.
- ▶ Human nature tried to concoct explanations for their occurrence after the fact, making them explainable and predictable.

Black Swan Events are impossible to predict because they are unpredictable by definition, Taleb contends. Don’t try to forecast low-probability, high-impact events (Black Swans), Taleb advocates. Focus on *reducing vulnerability* to such events. Better to evaluate the possible impact of extreme events than try to predict the unpredictable.

Transferrable knowledge

How often have you forecasted the total recordables your plant is going to experience in the coming year and exceeded the prediction?

I remember a client several years ago who was experiencing extremely poor safety performance with a significant number of employees being injured for a variety of reasons. Rather than engaging the employees in addressing the incidents, the client decided to arbitrarily forecast a 50-percent reduction in the injury rate for the coming year. Before



the end of the second quarter of the following year, the company had exceeded the number of injuries it had experienced in the previous year by 50 percent.

All we learn about predicting future behavior, events, or actions is that we get better at realizing how bad we are at predicting.

Can Black Swan events apply to safety incidents?

Some of the most catastrophic events in recent memory were Black Swan events: the 1984 methyl isocyanate release in Bhopal, India; the 1986 radioactive release and ultimate reactor meltdown at the Chernobyl nuclear power plant in the Ukraine; the 2003 loss of the space shuttle Columbia from insulating foam hitting the leading edge of the spacecraft’s wing during take off; and the Virginia Tech massacre of 32 students by

a mentally ill lone gunman.

In all four of these cases, there were pre-existing contributing factors that were known prior to the catastrophe. However, either those individuals in decision-making roles did not have the necessary information to make a good decision to prevent the catastrophe and/or the possibility of what eventually occurred was an outlier, which was beyond the decision-makers’ belief of what they expected could happen. In other words, there was a great disparity between what they actually knew and how much they think they knew. Taleb refers to this as epistemic arrogance.

So often when we are faced with significant safety issues we fall prey to a mental blindness of sorts. As Taleb writes, the problem lay not in the nature of events, but in the way we perceived them. I certainly appreciate the value of the tools (e.g., Root Cause Analysis, 5 Whys, Failure Mode and Effects Analysis, Fault Tree Analysis, etc.) safety pros use to determine reason(s) for a problem or event, but too often we get caught up in the methodology and either fail to, or are prevented from, taking action on the findings.

What value does Black Swan thinking bring to safety? It is all about reducing the vulnerability, targeting the consequences, and evaluating the possible impact of Black Swan events.

Ask yourself, “What is the worst thing that could happen around here?” Rather than thinking what the precise “event” could be, consider employing Taleb’s five modest tricks:

1 — Make a distinction between positive and negative contingencies. Learn to distinguish between those human undertakings in

which the lack of predictability can be (or has been) extremely beneficial (e.g., an injury-free year) and those where the failure to understand the future caused harm (e.g., a multiple injuries or fatalities accident).

2 — Don't look for the precise and the local. Don't be narrow-minded, be a systems thinker. Avoid trying to predict **precise** Black Swans – it tends to make you vulnerable to the Black Swans you do not predict. For example, do not predict that failure of performing a specific LO/TO on pump “x” of reactor “y” will result in catastrophe “z.” Instead, invest your time and money in preparedness, not in prediction.

3 — Seize any opportunity, or anything that looks like an opportunity. Many safety pros who live for the next negative Black Swan fail to discern when they are experiencing the benefits of a current positive Black Swan. Train your mind to recognize when things are going well and take advantage of the opportunity to promote whatever is causing this positive Black Swan to continue.

4 — Beware of precise plans by the government. Governments predict through the passage of laws and regulations – it makes them feel good about themselves and justifies their existence. This does not mean that government is useless; it does mean that you, as a safety pro, must keep a vigilant eye on the unintended consequences of government's precise plan predictions.

5 — Do not waste your time trying to fight a forecaster. Let's say you are the plant safety manager and you find yourself in a year-end meeting with your plant manager (the forecaster). Even though he may ask your opinion of his forecast of next year's safety goal, don't waste your time arguing with him. It is ineffective and, possibly, career damaging to moan about unpredictability; plant managers will continue to predict foolishly, especially if they are paid for it, and you cannot put an end to institutional fraud. Remember, if you ever have to heed a plant manager's forecast, keep in mind that its accuracy degrades rapidly through time. Taleb's advice, "...don't argue with him; just ignore him, or try to

put a rat down his shirt.”

Considering the odds that you were even born makes you an outlier, so by pushing yourself to make an extreme impact, this will qualify YOU as a Black Swan.

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1 Taleb, N.N. 2007. *The Black Swan – The Impact of the Highly Improbable*. Random House. New York, NY.

2 Taleb, N.N., D.G. Goldstein, and M.W. Spitznagel. 2009. “The Six Mistakes Executives Make In Risk Management.” In *Harvard Business Review*. 87(10): 78-81.

3 Taleb, pp. 138-141.

4 Taleb, pp. 21.

5 Taleb, pp. 206-210.



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