

Black Swans – Applicability to Lab Incidents



NEAL LANGERMAN

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Black Swans ... and lab safety

- Black Swan Events
 - Nassim Nicholas Taleb, 2001
 - Incident deemed highly improbable yet has massive consequences
- Criteria
 - The event was a surprise to the observer
 - The event has a major impact
 - After the event, it is rationalized by hindsight as if it could have been expected, but was not addressed by risk mitigation methods



Black Swans ... and lab safety

- Applied to Texas Tech
 - The grad student was clearly surprised
 - Really thought that wetted with solvent would suppress the friction sensitivity
 - Injuries changed the student's life
 - Incident changed TTU
 - Incident contributed to change in research labs
 - Peers “knew” he was “unsafe”; TTU lacked positive controls to identify and mitigate this behavior
 - **THEREFORE – a Black Swan**



Black Swans ... and lab safety

- Black Swan concepts should be used to identify leading indicators, not to rationalize past incidents
- Taleb has suggests an approach ...
 - **What is fragile should break early while it is still small.**
 - Experiments should have weak links that indicate impending failure (high set-points) and failure links that break before disaster occurs (High-High set-points)



Black Swans ... and lab safety

- **No socialization of losses and privatization of gains.**
 - Whatever may prevent the loss of life, physical impairment, or property damage should be required and whatever does not result in loss of life, physical impairment, or property damage should be free of restrictions, small, and risk-bearing.
 - Operators must be fully informed to understand and accept the risks



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- **People who were driving a school bus blindfolded (and crashed it) should never be given a new bus.**
 - PI's who were leading a research group blindfolded (and lab personnel are injured) should never be allowed to lead a research group again.
 - This is an issue that is currently being considered by the research community – it must be openly discussed, thus its appearance here!



Black Swans ... and lab safety

- **Do not let someone making an “incentive” bonus manage a nuclear plant**
 - Funding is an incentive that a PI operates with
 - A “degree” is the goal, not the incentive for a student;
 - A student who cuts corners to collect the data for an ACS meeting should not manage the nuclear plant



Black Swans ... and lab safety

- **Counter-balance complexity with simplicity**
- **Do not give children sticks of dynamite, even if they come with a warning**
 - High risk activity must be mitigated via simplification and controls.
 - High risk activity must be performed by responsible operators
 - Knowledge helps make an operator responsible
 - PHAs – even for lab-scale activity – provides the knowledge



Black Swans ... and lab safety

- **Citizens should not depend on financial assets or fallible “expert” advice for their retirement.**
 - EH&S are the “experts” even in the face of lack of familiarity with the tasks
 - “Experts” must recognize their own limitations
 - Lab personnel must think critically about “expert” information ...



Black Swans ... and lab safety

- **Make an omelet with the broken eggs**
 - The broken academic safety culture cannot be fixed with makeshift repairs
 - We will have to remake the system
 - Create a strong institutional safety culture by eliminating unsafe practices, marginalizing the poor performers, putting managers where they belong, clawing back the bonuses of those who created the broken culture, and teaching people to navigate a world with fewer certainties.



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- Use these thoughts to mitigate risk –
 - Consider the synthesis of a 9 Nitrogen to 5 Carbon compound (Triazido pentaerythritol)
 - The explosion may be rationalized as a Black Swan incident
 - Use what we know – in the above statements to mitigate the risk
 - What is fragile should break early while it is still small
 - Limit synthesis to < 10 mg



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- No socialization of losses and privatization of gains
 - Train the bench chemist thoroughly and supervise the work
- Counter-balance complexity with simplicity
 - What additional controls are needed and realistic



Black Swans ... and lab safety

- Black Swan thinking can provide leading indicators
- Rationalizing an incident as a “Black Swan” is sloppy thinking
- Stay Safe ... think twice and pour once!

