Can We Stop Misrepresenting Reality to the Public?

Franco Oboni, *Oboni Riskope Associates Inc.*, www.riskope.com
Cesar Oboni, *Oboni Riskope Associates Inc.*, www.riskope.com
Susan Zabolotniuk szabolotniuk@gmail.com

ABSTRACT

Numerous voices are raising around the world to show how misleading and fuzzy commonly used risk assessments methods are. These criticisms come at a time when public trust in “proponents of new projects”, operators, private or governmental, seems to have hit a low and the legal system “targets” public officers.
It is common that technical experts and the public strongly disagree in their analysis of risks.

Risk definition requires the evaluation of probability and consequences and those words are oftentimes enough to stir great worry to the public. Thus it is nowadays commonly understood that “reality” is not scientific, but resides in public opinion, hence urging technical people to communicate better, more transparently. Blatant failures on both counts have lead to the emergence of “new myths” used to justify complacency using “complexity” and other buzz words as an alibi.

This paper (together with its companion presented elsewhere) explores how poor “common practices” in Risk Assessment contribute to biasing project team, design teams opinions, skew decision-making process and finally misrepresent reality to the public resulting precisely in the raise of public distrust, legal implication witnessed around the world.

The discussion first reviews the pitfalls of common approaches (FMEA, Probability Impact Graphs) pinpointing them as possible causes of future legal liabilities. An alarming disconnect also comes from various codes, ISO 31000 itself has this flaw, invoking the term “acceptable”/”tolerable” without defining it or giving any guidance for its determination. Wide-spectrum public consultation could be developed to define a “modern” social acceptability criteria helping all the stakeholders making/understanding decisions.
Another alarming disconnect comes from the poor definition of consequences of mishaps and their societal ripple effects. This aspect is indeed mostly ignored in codes, leaving ample room to biases and censoring applied to potential losses.
In our society no one seems to have anymore the possibility of hiding behind a shroud of “carefully maintained” misrepresentation. It is time to act and “write the book” for proper risk assessments avoiding misrepresentations.

Biography

Franco heads Riskope, an international practice on Risk and Crisis Management based in Vancouver. Author of over fifty papers and co-author of the 2007 book entitled: “Improving Sustainability through Reasonable Risk and Crisis Management”. Franco regularly gives seminars, and workshops worldwide. Clients include the UNDP, Fortune 500, World Bank, several international mining companies, railroads, highways, harbors, luxury and food suppliers, military and numerous communities, regional and provincial governments.

Franco manages a broad range of risk and crisis mitigation projects, risk and security audits and geo-environmental hazard mitigation studies. Projects have included definition of needs, training for corporate clients, negotiations with community leaders, as well as the preparation of monitoring programs, Risk Assessments and Optimum Risk Estimates (ORE, the flagship product of Riskope). Franco teaches regularly customized seminars directly to interested industrial corporations (among his clients are BC Hydro, Mitsubishi Motor Company, Japan Metal Mining Association, to name but a few). Franco was co-recipients of the Italian Canadian Chamber of Commerce (Canada West) 2010 Innovation Award.

1. Introduction

Academic and popular literature suggest agreement that the public's distrust of industry has developed over the past half century as a result of repeated failures to provide adequate and/or accurate risk information to the public. In the public health arena regulators have traditionally been confronted with the difficult task of allocating risks and benefits; sometimes they have missed some important risks and sometimes they have spent a lot of money and energy on dealing with negligible risks (Bouder et al., 2007). Nowadays public opinion oftentimes concludes that research conducted or funded by industry is unlikely to result in credible risk assessments, to be presented to the public with accuracy and transparency. One needs only look at the tobacco industry's research on smoking risks (Cummings, Brown, O'Connor, 2007) or very recent "mining/ environmental" cases (Reviewboard, Giant Mine Hearing Transcripts, 2012) to measure public skepticism.

In the first half of the 20th century, scientists "may well have been viewed as trustworthy experts, but it mattered little to most people as they seldom came in close contact with science" (Jensen, 2000). The last half of the century saw phenomenal growth in science and research, with an accompanying shift in the perception as to the reliability of information. Survey data indicate that ratings of confidence in government and industry have severely eroded during the past thirty years." (Peters et al., 1997). In fact, "the scientific majority sometimes finds itself pitted against a public opinion which simply does not accept its conclusions" (Sjoberg, 1999).

Meanwhile, over the last five decades or so, the risk management community at large, including engineers, designers performing Risk Assessments on their own projects/designs for mining projects, oftentimes in a conflict of interest situation, has settled on representing the results of Risk Assessments using so called Probability Impact Graphs (PIGs). PIGs are ubiquitous, but have a number of staggering intrinsic conceptual errors, with potentially significant negative consequences on their users (NASA 2007). ISO 31010 international code, after giving a detailed "non partisan" description of PIGs, details their limitations including their very subjective nature, difficulties in prioritizing risks across systems and a tendency to underestimate risks. Technical literature has begun to specifically address PIGs logical and mathematical limitations (Cox *et al.* 2005, Cox 2008, Cresswell, Hubbard 2009, Chapman,Ward 2011, Oboni, Oboni, 2012).

The implications of poor risk prioritization for the mining industry's balance sheet can be staggering, aside from the possible liabilities. Inaccuracies can lead to mistaken resource allocation, create fuzziness, offer little support to rational decision making and lead to public distrust and loss of confidence because of their arbitrariness. It does not come as a surprise then to recognize that, contrary to what is proposed by international Codes like ISO 31000, communication and risk approaches are poorly developed through the life of projects and operations (Fig. 1).

2. Pitfalls of PIGS/FMEA

The continued "main stream" reliance of using inappropriate techniques like PIGs and arbitrary judgments, and being satisfied with their results, is simply another manifestation of humans finding ways to introduce irrelevant criteria in decision-making (Kahneman & Tversky 1979, quoted in Oboni & Oboni 2007): humans tend to be risk-averse when facing the prospect of a gain, and paradoxically risk-prone when facing the prospect of a loss: using improper methods like PIGs, sits unfortunately well with "main stream" human nature. Once it is accepted that PIGs are no more than a help for discussions, are not an assessment tool, (NASA, 2007) and using them for other purposes leads at best to wasting precious mitigative funds (Cox 2008, Hubbard 2009, Chapman & Ward 2011), the need for new tools becomes blatant: by deploying better risk prioritization, we allow our rational ego to make better informed decisions.

If engineers and designers persist in using PIGs improperly to perform tasks they are not foreseen to perform, ignoring the conflict of interest that underlies a designer performing a risk assessment on their own design, we can foresee that soon cases will be challenged in courts of law against these practices. The questions that could be asked will tend to prove that the approach constituted professional negligence due to blatant breach of the

Duty of Care (See for a complete discussion blog reference *1 in the Literature) and will range, for example from:

- What is the basis for defining consequence (loss) classes in your PIG?
- Which studies did you develop to define the various class limits of likelihood, and losses?
- On which basis did you select those limits?
- Which criteria did you use to select the colours of your cells, which correspond to various levels of criticality?
- What criteria did you use to define those levels of criticality?, etc.

We doubt a PIGs user will be in a strong arguing position. The next sections will show how to avoid these pitfalls and their unpleasant consequences.

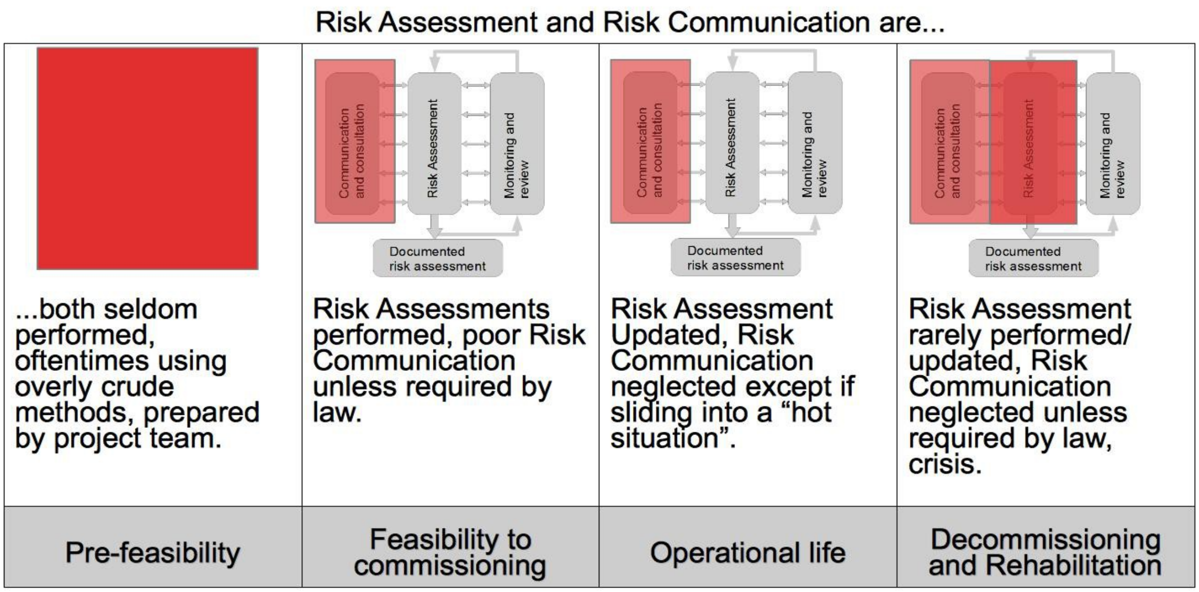

Fig. 1 The evolution of Risk Assessment and Communication through a Project and Operational Life. The scheme displayed for the risk assessment at each phase is the ISO 31000 scheme, which includes Communication (left side) and Monitoring (right side). Red shaded panels indicate poorly performed functions of the risk assessment process.

3. Misleading Codes/Acceptability

In the public health arena, it is recognized (Bouder et al., 2007) that, in view of the impressive body of evidence (HSE, 1988, 2001), the so called Risk Tolerability framework has been very successful at dealing with critical issues and supporting decision making. Risk assessments *per se* do not really help in making any decisions on risk reduction/accident prevention and other mitigative plans, but they become rationally operational only when their results are compared with a tolerability threshold (Fishoff & Al. 1982). For Risk Tolerability to be put into operations successfully, two fundamental components are necessary (Bouder et al., 2007):

a) an acceptance and a legitimization by all stakeholders of the need to balance risks (being regulated or created) against the costs involved in controlling such risks; and
b) a form of institutional decision-making that allows "balancing of risks and costs", but ensures that decisions are reached.

There are no formally recognized regulatory criteria for tolerable risks to personnel in the mining industry, and almost paradoxically, high-level corporate strategists flirt nowadays with the concept of risk appetite, after having carefully avoided selecting a corporate tolerability threshold. It seems hard to imagine an operational risk assessment, where consequences of a mishap may involve casualties among the workforce or outside of a facility, using the “risk appetite” terminology, especially in relations to rampant public distrust. PIGs-based risk assessments introduce unpleasant fuzziness as tolerability/acceptability is defined by arbitrary “steps” within the probability/severity matrix. Quantitative Risk Assessments (QRAs) instead provide a rational platform for decision making based on the comparison of the assessed risks with Quantitative Risk Tolerability Curves (QRTC) (Oboni, Oboni, 2007, 2012), provided due regard is given to uncertainties.

3.1 Existing Thresholds

Comar, Wilson (Comar, 1987, Wilson & Crouch, 1982), then later, in the field of chemical industry, Renshaw (Renshaw, 1990) defined simple societal risk acceptability criteria expressed as probability of fatality of one individual per year of risk exposure in the range of 10^{-5} to 10^{-6} , which is coincidentally also the technical threshold of “credibility” in many industries.
Many publications from reputable (governmental, research) sources point at a probability (of a casualty per annum) of 10^{-4} as being the limit of “safe”, with a lower limit of 10^{-6} for unwillingly exposed public (See *2, *3 in the Literature).

The British Health and Safety Executive (HSE), (HSE, 2001), defines three zones for risk acceptability in terms of frequency of death per year: one corresponding to an unacceptable risk, one corresponding to a tolerable risk and one corresponding to a broadly acceptable risk for workers and “people outside the plant”. In both cases, the broadly acceptable limit is 10^{-6} casualty per annum.

PIGs cell colouring, which are commonly not declared as a depiction of “acceptability criteria”, but actually are the only way to discriminate risk scenarios, are arbitrary in nature and correspond to an artificial “binning” exercise. They expose their users to legal liabilities, especially if the said PIG's colouring leads to fallacious risk prioritizations. Albeit a QRA's explicit frequency and probability may oftentimes be poorly understood by the public, the “blinding effect” generated by the arbitrary colouring or indexing of the PIGs' cell amplifies public's distrust.

3.2 Public Consultation to Define Acceptability

3.2.1 Risk Communication

It is normally accepted that experts will disagree in their analysis of results, such as with probability or frequency estimates for an event. However, if and when the public disagrees with an expert analysis of risk, they are dismissed as being highly emotional or lacking scientific literacy.

Scientific literacy “stands for what the general public ought to know about science” (Durant, 1993), essentially a minimum understanding by the general public that would enable them to participate in, for example environmental decision-making and “help solve practical problems” (Shen, 1975). This concept is important because, while there is an accepted difference in scientific literacy between the public and scientific experts, there is an assumption that the public are ignorant about scientific risk and probability and that an increased scientific literacy would help decrease perceived risks (Frewer, 2004).

An increase in scientific literacy may in fact increase perceived risks, but the question remains as to whether the level of required scientific literacy is “so high that it is difficult to attain and difficult to motivate the public to attain it” (Frewer, 2000). It is simply unrealistic that the average citizen can obtain sufficient scientific literacy to thoroughly tackle any or all technical risk reports, be they nuclear, energy, or mining. The bar or standard must be reasonable. Consequential to this is that corporations must communicate risk information to the public that would be accepted as technically adequate and seemingly objective, a difficult task. Risk managers must move their communication approach from that of paternalistically doling out pieces of information that support their risk management approach to partnering with the public (Fischhoff, 1995) to demonstrate that the practices meet socially acceptable levels and practices.

Two components of (environmental) risk communication are trust and credibility, which corporations must earn (Peters, Covello, McCallum, 1997). Research must aid risk analysis and policy making by, in part, "improving the communication of risk information among lay people, technical experts, and decision-makers" (Slovic, 1987). The goal of risk communications seems unclear given the decades of failed communications. "Avoiding all conflict is not a realistic, or even a legitimate, goal for risk communication" but rather to have "fewer, but better conflicts" (Fischhoff, 1995) guided by facts.

3.2.2 Public Consultation & Participation

Partnering with the public requires effective communication, but more importantly, public consultation and participation. Rowe et al (2004) differentiates communication and public participation, the latter being used to solicit public opinion and engage in active dialogue. The following analyzes public consultation and suggests an approach where technical expertise can best be integrated with local knowledge (Webler & Thuler, 2000).

A challenge with public consultation is that the approach used to obtain input raises chances that disadvantage groups may be excluded or may be dominated by special interest groups (Abelson et al, 2003). To be effective and obtain participation of a representative group, meetings may need to move from town to town or be held on weekends to facilitate attendance and fair participation (Webler & Thuler, 2000).

Rowe & Frewer (2000) established acceptance and process criteria, the former ensuring that participants are representative of the affected population and that they are involved as early as possible in the process. Process criteria require participants to have access to appropriate resources to enable them to successfully fulfill their brief.

The process by which public participation can be obtained has been well researched. Included in this research is a recognition that a minimum level of scientific literacy would greatly facilitate effective more communications, and potentially partnerships, between the public and environmental risk professionals. In the absence of that minimum scientific literacy, it would fall entirely on the risk professional to communicate in a manner that provides for an effective understanding by the public. Confusion would limit the risk professionals ability to form the appropriate partnership and gain the necessary project support.

4. How to Proceed to Avoid Misrepresentation

Regularly, when a project is publicly presented, a "narrow angle" approach is applied to risks, separating "engineering", "long term", and "toxicological". Holistic approaches are uncommon, especially if designers/engineers perform or are too close to the Risk Assessment consultants, as this almost inevitably leads to conflicts of interests and biases. Separating issues is intrinsic to good engineering practices, training and experience, while remuneration of engineers oftentimes prevents "thinking about the unthinkable", an essential need for serious risk assessments.
As a result, risk assessments are almost always censored and biased towards "credible events". However history, even recent, has shown that major failures occur when "incredible events" occur, or long chains of apparently benign events are produced and the public has got that clearly in mind. Of course, the biased/censored approach becomes even more critical when long term (perpetuity) is considered and the question is to define a maximum credible scenario on a project that will be present for perpetuity (tailings, for example).

Approaches ranking risks as a function of their intolerable part, i.e. the "amount of risk" that is deemed intolerable for a specific project, endeavour, etc., in lieu of biased and censored "binning risks" in PIGs, have been successfully deployed in various industries, including mining (Oboni, Oboni, 2007, 2012). These approaches (ORE: Optimum Risk Estimates) compare the relative value of the intolerable risks, leading to a rational, transparent prioritization, while defining drillable hazard and risk register finally yielding clear road maps for mitigative decision making. Especially for very large projects, risk assessments generally consider too simplistic consequences and ignore "indirect/life-changing" effects on population and other social aspects that can be grasped in ORE using simplified method and considering the wide uncertainties that surrounds the driving parameters. Among these:

- human H&S,
- fish, fauna and top-soil/vegetation consequences,
- long term economic and development consequences, and social impacts.

Recommended consequence models should include (WBGU, 2000):

- Extent of damage as expressed in casualties, wounded, business interruption etc. possibly merged into one metric, with the inevitable uncertainties,
- Geographic dispersion of damage
- Duration of the damage
- Reversibility of the damage (or perpetual loss?)
- Latency between an accident and the occurrence of its damages
- Social impacts (inequity/injustice, psychological stress and discomfort, conflicts and mobilization, pill-over effects).

In contrast to PIGs users, the replies that ORE users can give if asked to justify their doing (See *4 in the Literature) are sensible, rational, transparent, well documented and defensible.

4.1 Short Term Cases

Before some recent Public Hearings, one reviewer noted: "*For this project, most concerns and questions revolve around the risk acceptability criteria and its transparency for the public. Mitigative structures and measures should be designed in function of the accepted risk criteria as by definition zero-risk does not exist.*
Human endeavours should seek a cost vs. risk balance, and that balance has to be dictated by a transparent acceptability criteria and consequence analysis; final decisions have to be risk-driven and not gut-feeling driven, especially if the possible outcome of a mishap includes casualties and long-term environmental issues".

Holistic means, in this context, that a 360-degrees analysis of hazards and potential crises will be undertaken. Risks will need to be compared to a openly discussed societal tolerability criteria recognizing that unless, consequences are properly quantified (that does not mean one number, but a range, of course to include the inevitable uncertainties), the risk assessment will misrepresent the case.

Projects developing "infant diseases" due to the incomplete risk assessments performed by teams eager to "get going" are numerous. Many cases of insurance denial now plaguing the mining industry are resulting from this widespread epidemic, together with geopolitical and climate change effects. Poor and biased Risk Assessments have actually backfired and damaged the industry as a whole. A recent sentence by an Italian court on the failure to perform a proper risk assessment and a proper risk communication procedure to the public leads us to believe that the legal system is catching up with misleading studies and confused information (See *5 in the Literature).
Remedies exist, are feasible and sustainable and can be implemented:

- Avoid conflict of interest and biases,
- Explicit negotiated tolerability,
- Proper consequences analysis,
- Avoid "binning" exercises and conflict of interest.

4.2 Long Term Cases/Perpetuity

The discussion and measures developed for the short-term case works also for the long term. However, on the long term, probabilities of failures and, most likely consequences, will increase: the first because the level of care and maintenance is released, the second because of demographics and “world changes”.
In contrast to hydro dams that would typically be breached upon the end of their production life, at mine operation closure starts the longest state of being for its Tailings Dams , regardless of the duration of production phase. There are basically four tailings dam ‘operating’ phases that may apply to most mine sites (M.B. Szymanski, M.P. Davies, 2004): Production (tailings disposal), say 20 years duration; Transition (preparation for the closure phase, may include flushing out contamination); Long-term treatment (dam operation continues in the sense of regulated water levels); Closure (dam is no longer operated in the sense of regulated water levels), likely more than 1,000 years.

Production is the phase with the highest monitoring and care, Transition and Long-term treatment are phases during which monitoring and care are gradually reduced, and Closure is the phase during which the dam is “abandoned”. A Maximum Design Hazard may, of course, occur during any of these phases, but the longer the exposure the highest the probability a hit will occur.

If we add to this moving target the fact that new natural/man-made hazards may emerge, and that climate changes and regulatory environment may be altered, we easily understand that risk assessments cannot be static.

These apparently daunting problems could be tackled in a significant better way by introducing:

- Drillable registers,
- Business intelligence based records,
- Rational updating.

5. Conclusions

“Common Practices” do not equate to “Best Practices”: common practices are not to be proposed/used any longer if we want to avoid public distrust and misrepresentations.

Many of the “modern” issues ranging from public distrust to insurance denial could be relieved or mitigated ahead of time if misrepresentation was kept at bay by at least the following measures:

a) proper Risk Assessments including explicit tolerability and more sophisticated consequences definition,
b) the concepts of Risk would be formally introduced earlier in the development,
c) Risk Assessments were not used as an alibi for poor scrutiny,
d) public consultation and participation were fostered from inception,
e) conflict of interest and biases were avoided by using exclusively third parties to perform risk assessments.

As it results from the discussion above, we think that common practice Risk Assessments, especially those developed under conflict of interest situations, generally misrepresent risks and fail to give the “big picture”, hence do not help taking valid decision and are prone to generating/fostering public distrust.

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