

Is preventing mine waste disasters & water pollution possible?

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Turning Down the Heat: Can We Mine Our Way Out of the Climate Crisis?

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Is preventing mine waste disasters & water pollution possible?

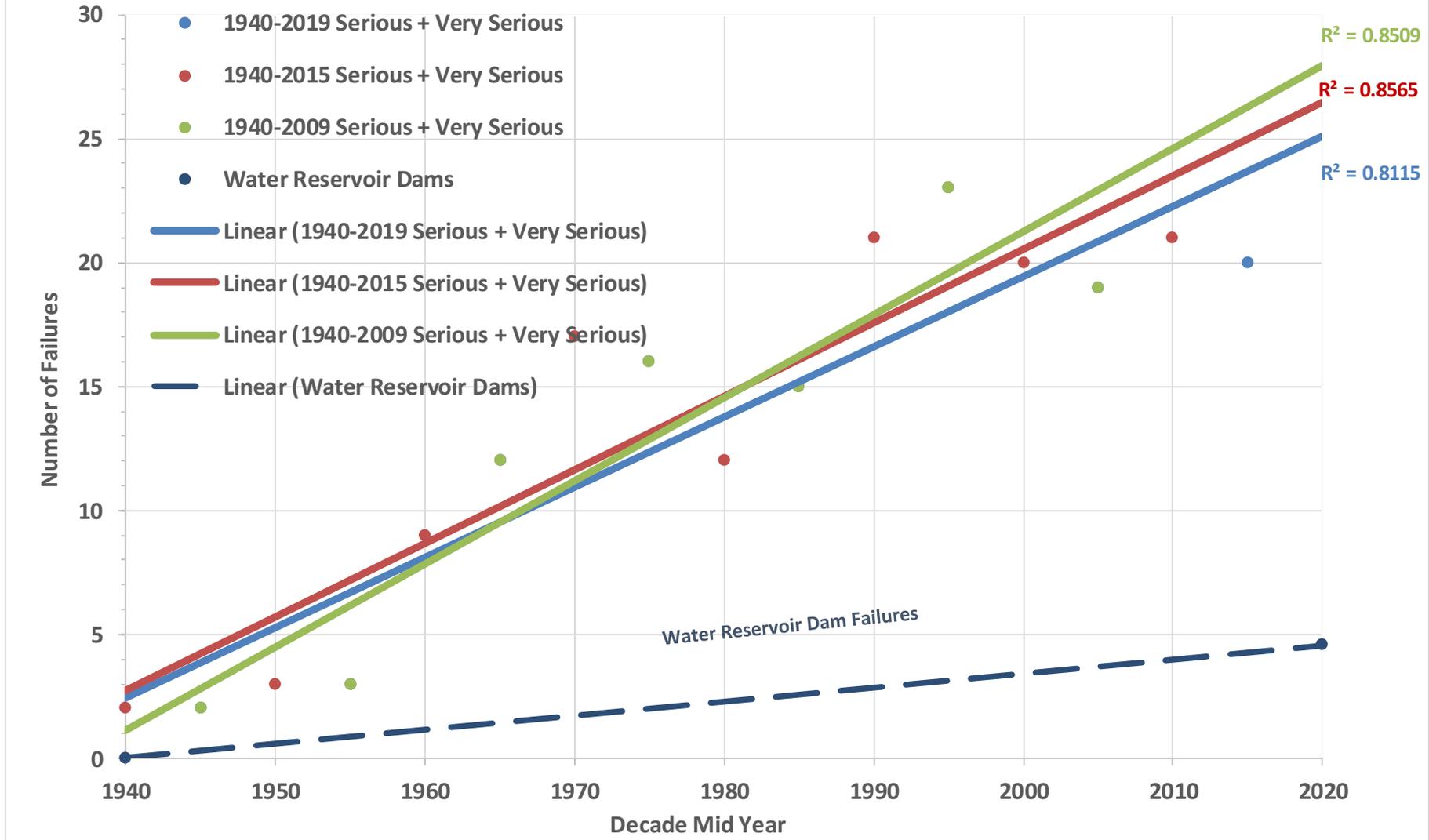
- Defining the problem
 - Mine Waste Disasters – Catastrophic Failure of Tailings Storage Facilities
 - Mt Polley
 - Samarco
 - Fundao
 - Water Pollution
 - Mining Influenced Water
 - Prevention
 - Source Controls
 - Management and Treatment

Prevention of Catastrophic Failures

- Will always be subject to potential for human error, but can be significantly reduced
 - Aeronautical examples
 - And exceptions – Boeing 747 MAX



Serious & Very Serious Failures



Prevention of Catastrophic Failures

Policy Approach: Ban upstream tailings; Ban wet tailings; Ban tailings upstream of major population centers

Engineering Approach: Mining catastrophic failures can be minimized by:

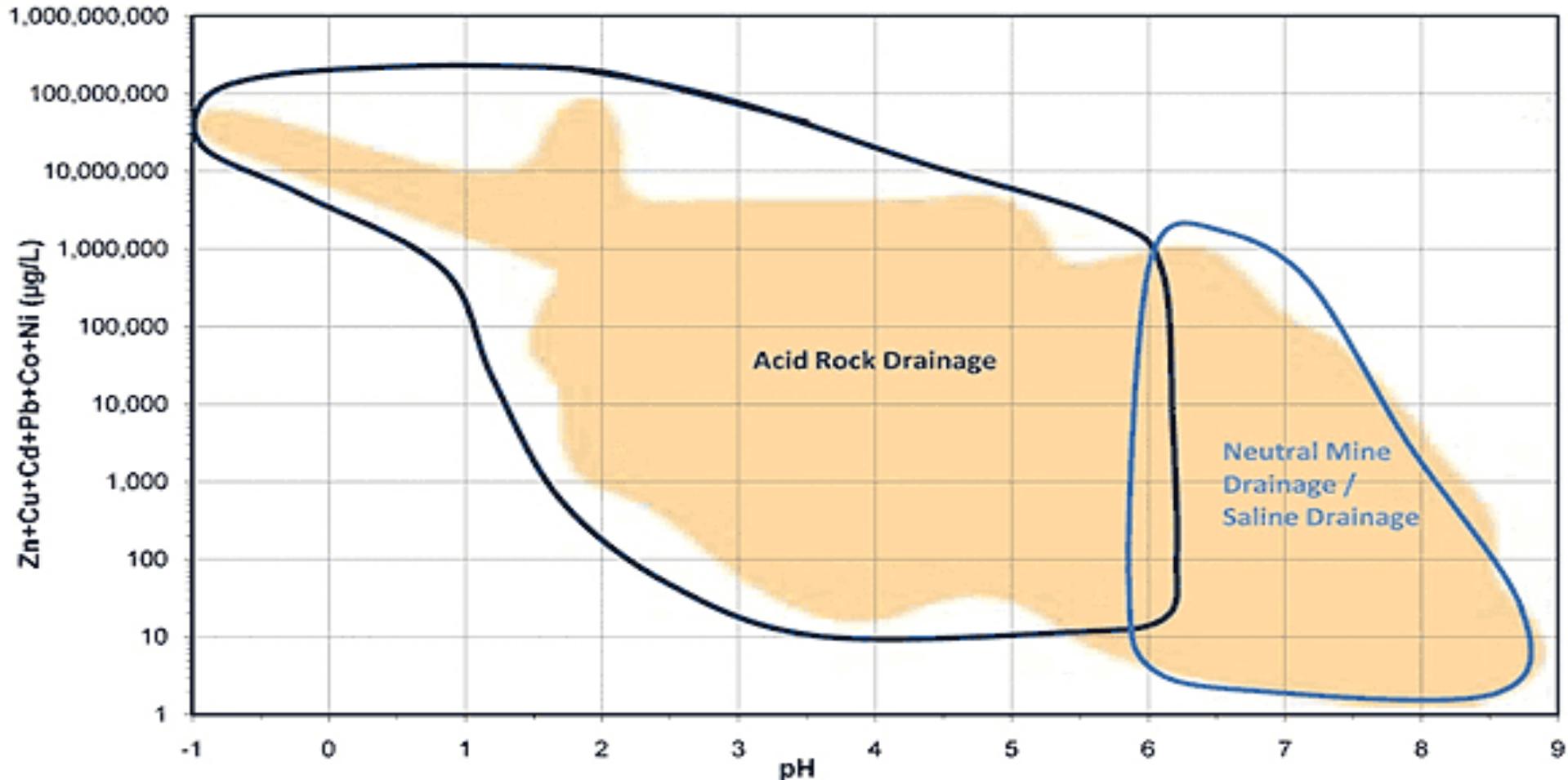
- Adherence to recognized engineering best practice and guidance
- Addressing normalization of deviance – root cause of most failures
- Rigorous risk assessment and independent review
- Addressing future engineering capacity, engineering ethics
- Involving and informing stakeholders and public

Definition of Mining Influenced Water (MIW)

- Waters that have been impacted by mining or mineral processing activities have been coined Mine Influenced Water (MIW).
- MIW includes
 - surface water on and off the mine site;
 - groundwater below and adjacent to the mine site;
 - pit lakes formed by the excavation and flooding of open pits;
 - mineral and metallurgical process waters and ponds;
 - waters draining from leach pads;
 - stormwater ditches and catchment basins;
 - water draining from waste rock dumps and ore stockpiles; and
 - water delivered to and draining from tailing ponds.
- Mining Influenced Water includes Acid Drainage (AD), Neutral Drainage (ND), and Saline Drainage (SD).
- A key characteristic of most of these waters is that they contain elevated concentrations of metals that have leached from surrounding solids (e.g., waste rock, tailings, mine surfaces, or mineral surfaces in their pathways).

MIW Drainage Chemistry

Figure 1: Ficklin Diagram Showing AD, ND, and SD as a Function of Dissolved Base Metal Concentrations (adapted from Plumlee et al., 1999)



Prevention of Mining Influenced Water

Policy Approach: No Sulfide Mining, No Mining if Perpetual Treatment Required

Engineering Approach: MIW can be minimized, and in some cases prevented, by hierarchy of:

- Prediction
- Avoidance
- Waste Minimization
- Source Controls
- Management and Treatment
- Financial Assurance

Is preventing mine waste disasters & water pollution possible?

- Improvements in engineering practice and application needed
 - Standard of Care not adequately delineated
 - Must be globally applied
 - Shortage of qualified engineers
- Law of diminishing returns and zero risk
- Industry will not change unless/until society demands it