Villains, Victims, and Heroes

Accounting for the Roles Human Activity Plays in LOPA Scenarios

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BLUEFIELD PROCESS SAFETY

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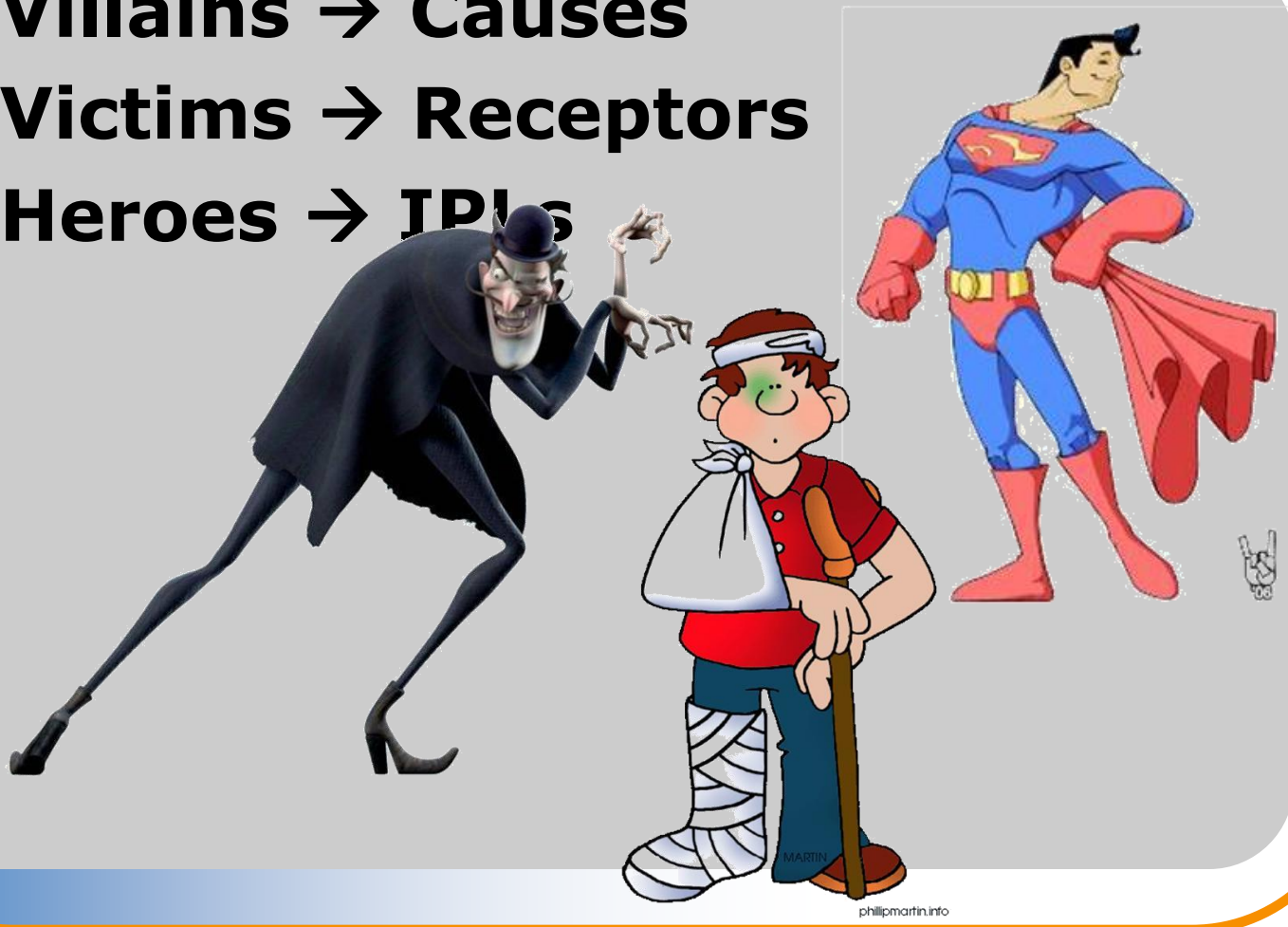
Three Roles

- **Villains**
- **Victims**
- **Heroes**

Three Roles

- **Villains → Causes**
- **Victims → Receptors**
- **Heroes → IPLs**



Human error

- **Lapses**
- **Mistakes**
- **Violations**

Lapses

- They know what they should do
- They want to do what they should do
- They are capable of doing what they should do

Why lapses occur

Occur, not in spite of, but because of being well trained

- **Inappropriate responses:**
  - **Exhortation**
  - **Punishment**
  - **Further training**
- **Appropriate responses:**
  - **Accept lapses**

    OR
  - **Redesign work process**

Mistakes

- **Significance of readings or warnings not recognized**
- **Ignorance of hazards**
- **Ignorance of scientific principals**
- **Errors in diagnosis**

Why mistakes occur

Occur because of inadequate training

- **Inappropriate responses:**
  - **Exhortation**
  - **Punishment**
- **Appropriate response:**
  - **Further training**

Violations

- **Deliberate decision to not carry out instructions**

Why?

- **Considered unnecessary**
- **Considered incorrect**
- **Maliciousness**

Follow up to violations

- **Are the rules known and understood? Is it possible to follow them?**
- **Are the rules really necessary?**
- **Can the job be simplified?**
- **Do people understand the reasons for the rules?**
- **Have breaches been ignored or rewarded in the past?**
- **What would have happened if no accident had occurred?**

Stochastic human reliability

- **Applies only to random errors**
- **All lapses are random errors**
- **Mistakes may be random errors**
- **Violations rarely are random errors**

Design basis for human error

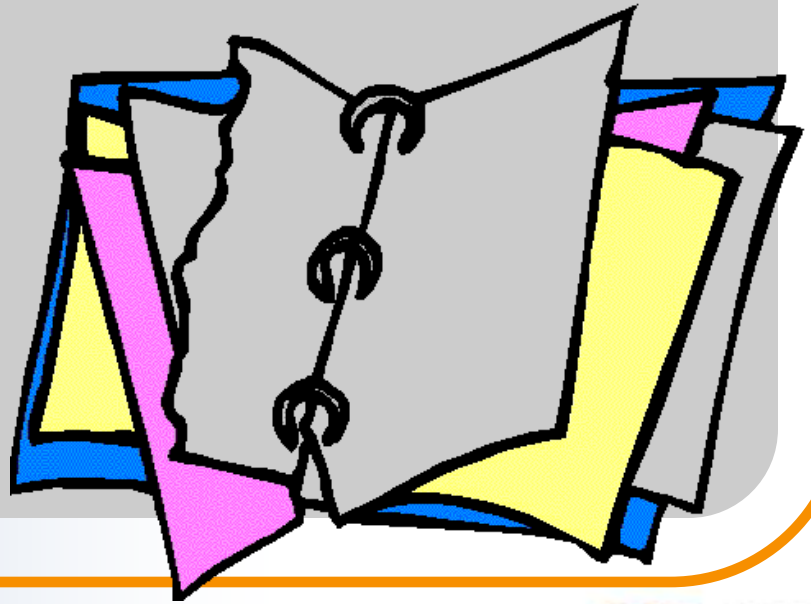
- **Error during high-stress, non-routine task: P = 1**
- **Error during routine, or low-stress task: P = 0.1**
- **Failure executing routine written procedure: P = 0.01**
- **Failure executing special written procedure with check: P = 0.001**

Human Activity as a Cause

- **Design**
  - **Engineering**
  - **Programming**
- **Operation and Maintenance**
  - **Operator Error**
  - **Pilot Error**
  - **Human Error**

Procedural Deviations

- **7 Parameters**
  - Omitted
  - Wrong Order
  - Timing (Early/Late)
  - Duration (Short/Long)
  - Partial
  - Additional
  - Wrong Action
- **2 Parameters**
  - Omission (Did not do)
  - Commission (Did wrong)



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What to do about human causes

- **Reduce the number of opportunities to for the error, typically a lapse**
- **Reduce the probability that the opportunity will result in an error**

Reduce opportunities for error

Do it less often

- **Better design so maintenance is required less often**
- **Simplify or eliminate processes and procedures to have fewer steps**

- **Note: Flexibility almost always comes at the cost of greater complexity and increased error**

Reduce probability of error

- **Improve procedures**
- **Add checklists**
- **Improve training**
  - **Training can turn emergency tasks into routine tasks**
  - **Training can turn high stress tasks into low-stress tasks**
- **Automate**
  - **Tasks and sequences**
  - **Calculations**

Not Initiating Events or Causes

- **Ineffective management systems**
- **Inadequate training or certification**
- **Inadequate testing or inspection**
- **Failure of critical response**

May contribute, but not initiating events in themselves

Victims – Humans as Receptors

- **Safety**
  - **Operating staff**
  - **Maintenance staff**
  - **Contractors**
  - **Others**
- **Community**
  - **Neighbors**
  - **Visitors**
  - **Passers-by**

What to do about victims

- **Reduce the number of people exposed**
- **Reduce the time people are exposed**

- **Safety – Occupancy factor**
- **Community – Little to be done**
  - **Location selection**
  - **Manage buffer zone**

Human activity as an IPL

- **Administrative controls**
- **Human response**

Administrative controls as IPL

- **Procedural measure**
- **Relies on human action**
- **Routinely done to prevent hazard**
- **Not done in response to hazard**

- **Must be independent of failed procedure that is cause**
- **PFD_{AVG} = 0.1 for administrative control**

Training should include

- **Awareness training**
  - **Procedure is safety critical**
  - **Hazardous event prevented**
  - **How the procedure prevents the hazardous event**
- **Confirmation of understanding and ability to perform procedure as designed**
- **Records of the training**

Human response as IPL

- **Effective, independent, auditable**

Three questions:

- **How will the unsafe condition or event be detected?**
- **How will the decision to act be made?**
- **What action will be taken to deflect the hazardous outcome, preventing the event?**

Success of human response

- **Assumes sufficient training to avoid mistakes and violations**
- **Assumes sufficient response time to**
  - **Detect**
  - **Decide**
  - **Act**
  - **Take Effect**

PFD_{AVG} of human IPL

- **In addition to sufficient response time**

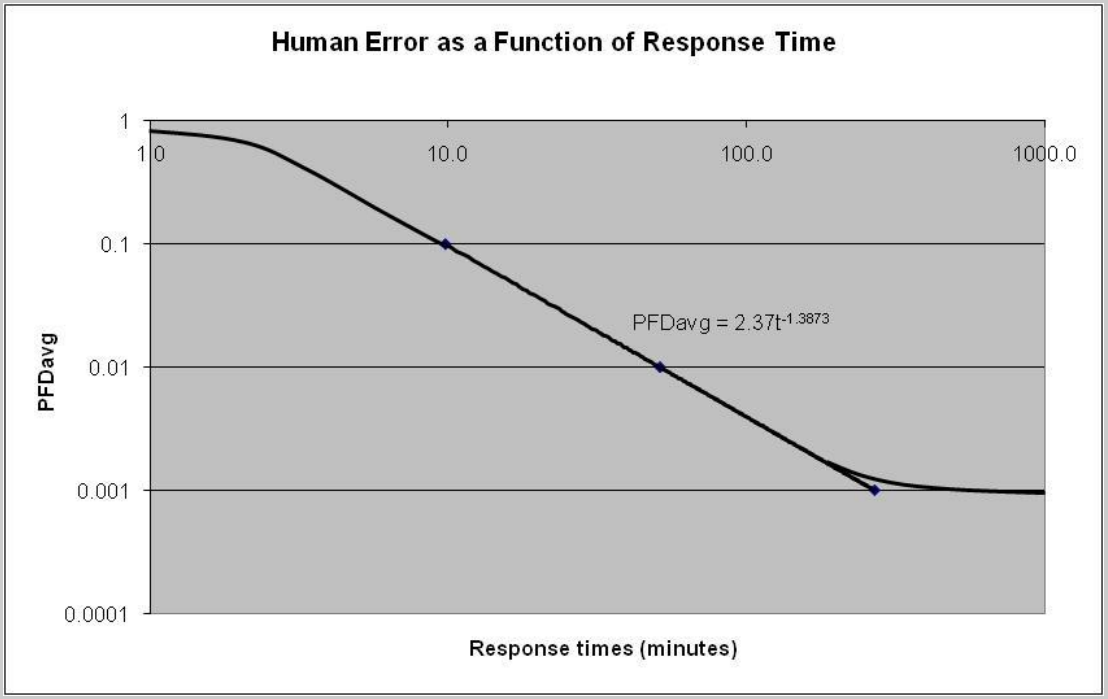
  THERE MUST BE

- **Sufficient buffer time**

- **With no buffer time, human response must be perfect to succeed—and no one is perfect**

Buffer Time

- t < 5 min, PFD_{AVG} approaches 1
- t > 4 ½ hours, PFD_{AVG} = 0.001



Human IPLs

- **At least 10/15/20 minutes buffer to respond 0.1**
- **At least 45/60/90 minutes buffer to respond 0.01**
- **At least 5/8/10 hours buffer to respond 0.001**

Notes about human responses

- **Most companies only allow for the first IPL or sometimes, the first two IPLs**
- **Human response, no matter how much buffer time, can be no better than the reliability of the detection and action**

Summary

- **Human involvement in LOPA scenarios includes causes, receptors, and IPLs**
- **Random human error occurs at predictable rates, depending on the nature of the error**
- **Human IPLs include both administrative procedures and human responses**
- **The PFD_{AVG} of human responses depends on the amount of buffer time available in addition to response time**

Questions?