Industrial Laser Incident-Accident Report Forms

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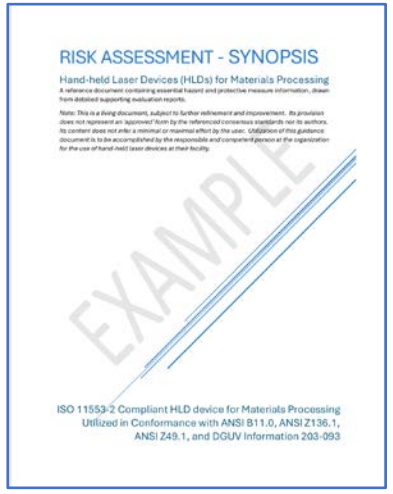
R. Paura, Dynamic Laser Solutions, Inc.

- Special purpose machine design & build experience (macro laser materials processing)
- Automotive, aerospace, heavy equipment
- Professional Engineer,
- Certified Laser Safety Officer,
- (ANSI) B11 Licensed Machine Safety Specialist
- Member ANSI Z136, SCC, & IEC TC76



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Content:

- Incidents, accidents, and hazardous events
- Legal basis and references
- The risk assessment
- Scope of the report form(s)
- Utility of the incident report form
- Investigation and corrective action(s)
- Whitepaper and example attachments

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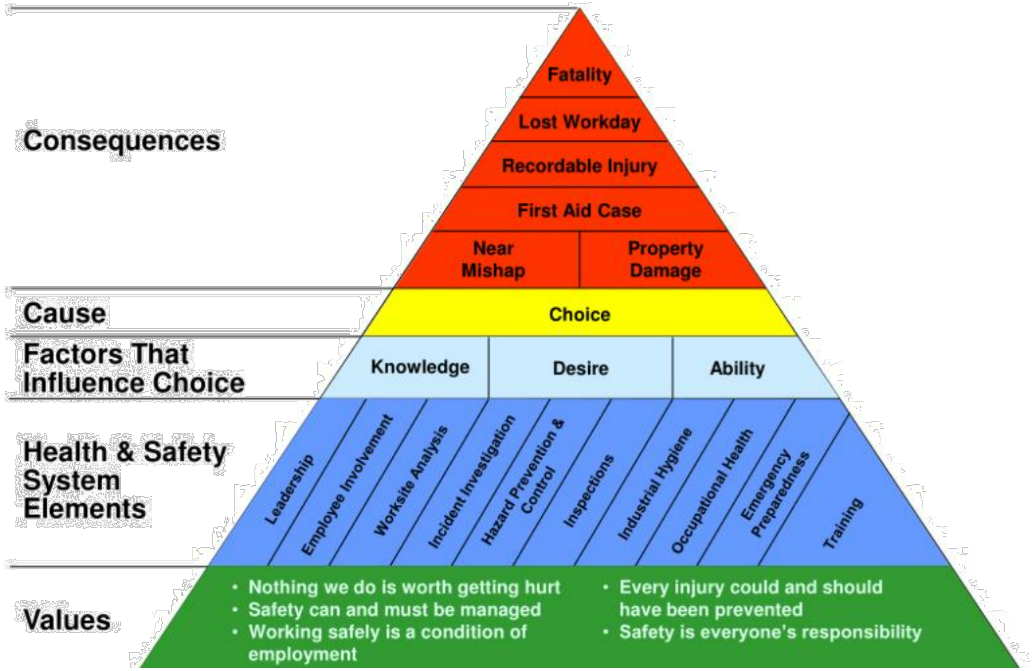
Incidents, accidents, and hazardous events:

- ~~Accident: harm, injury, or fatality (but implies no one is at fault).~~
- Incident: applicable to actual or potential hazardous event.
- --
- How is our health and safety management system(s) configured to minimize the unwanted or incorrect decisions which adversely influence workplace safety?
- As much as 96% of all incidents involve human choice.
  - Ref. Joy Wade, 2012
    "The Role of Senior Leadership"
- *Fix the process/gap so people know the risks & can make the right decisions*



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How are we doing for workplace safety?:

	Non-fatal occupational injuries per 100,000 workers	Occupational fatalities per 100,000 workers	Inspectors per 10,000 employed persons
Canada	1,464	5.7	0.1
U.S.A.	900	5.3	0.1
United Kingdom	692	0.8	0.3
France	3,043	2.6	0.8
Germany	1,496	0.7	1.4
Mexico	2,529	7.7	0.1
Brazil	1,374	Not Available	Not Available

- https://ilostat.ilo.org/topics/safety-and-health-at-work/
- Refer to the database for caveats on the coverage of these statistics. *Last update: 11 January 2024*
- **Source:** Occupational Safety and Health Statistics (OSH) database, ILOSTAT

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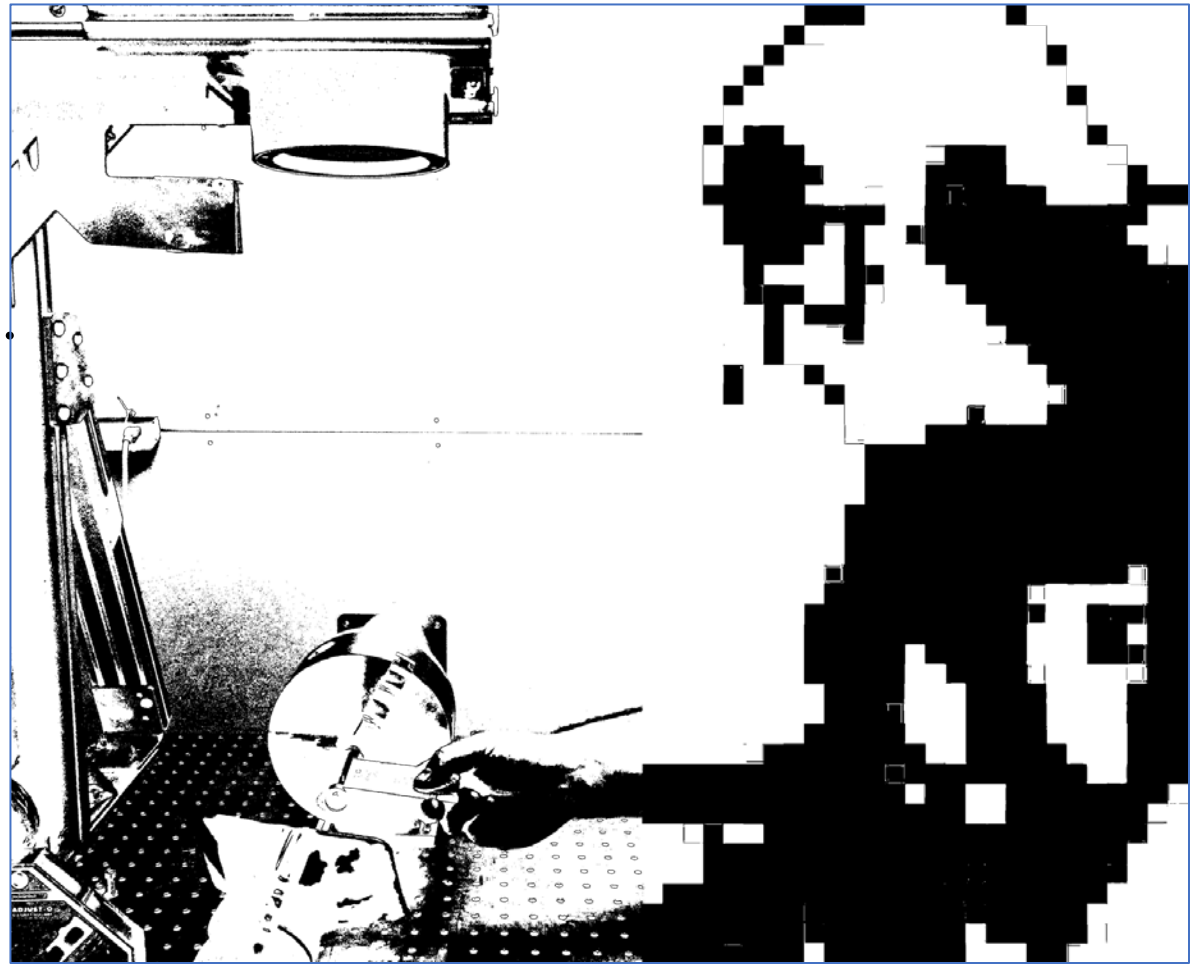
Example situation:

- Yes, it really happened!
- Laser lab, NIR ablation, operator experienced pain in one eye (cornea).
- Went to hospital, treated, per the written laser safety policy.
- Facility LSO could not get to root cause, contacted additional help.
- Medical treatment report was essentially ‘verbal’.
- Was it thermal or an abrasive injury?



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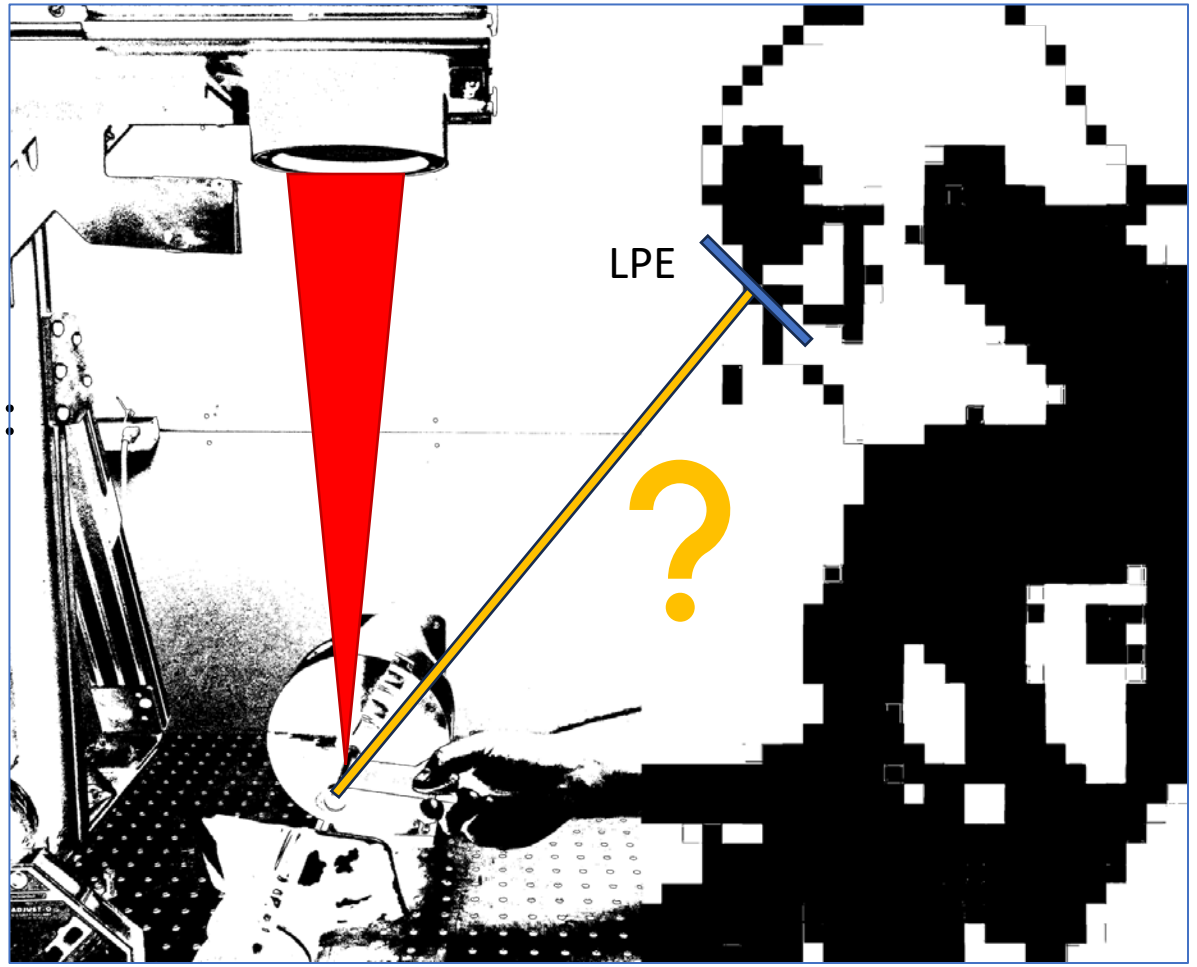
Example situation:

- Facility had conducted an initial risk assessment.
- Operator was wearing LPE.
- Preliminary questions/determination:
  - Abrasion from particulate
  - Process re-radiation of different wavelength
- Raised new questions on guidance provided in consensus standards and regulations.



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Legal basis:

- Each jurisdiction (Federal, State, Provincial, Territorial) having authority for workplace safety will require serious injury or fatality reporting.
- Ref.: CCOHS: Health and Safety Legislation in Canada - Injury Reporting
  US OSHA: Recordkeeping | Occupational Safety and Health Administration

? How is our organization set for responding to those other hazardous events?

? Can we demonstrate due diligence in our execution of our general duty of care?

? Have we walked through an incident in development of the response plan?

? For our records and incident investigation, how do we document such?

- Forms can provide the structure and organize information. With provisos.
- "*It is not about paperwork, but our feedback loop for continuous improvement.*"

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The risk assessment:

- Many incident report forms cover the equipment and personnel decisions.
- ? But how many ask for the original/recent equipment/process risk assessment?
- ? How many ask about the details of the injury itself, which can be helpful for root cause analysis?
- ? If no (initial) risk assessment available, then why? Is that a systemic failure?
- Internally, we need to just as seriously address those potential hazardous events as actual ones – per the Serious Injury or Fatality (or Heinrich's) pyramid.
- What are the best practices of internal incident report forms and incident investigation?

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Scope of the report form(s):

- Aligned with or familiar to regulatory report forms.
- Can be basic or an intake form.
- Types range from positive observations to fatalities.
- In a timely fashion: capturing essential information for root cause analysis – don't necessarily assume – provide unbiased guidance.
- Can be improved over time.

Basic Incident Report Form:

- Incident situation
- Hazardous event description
- Effects of the hazardous event.
- Interim measures.
- The affected person.
- Witness details.
- First aid provision.
- Post incident.

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Incident report form utility:

- Part of incident response plan, demonstrates due diligence
- Captures key information immediately after an incident
- Checked against the risk assessment or job hazard analysis
- Essential for the incident investigation and root cause analysis
- Part of the safety plan for who is responsible for what
  - Information is not just gathered and sit on a shelf
  - If a potential hazardous event is not resolved, then it will likely be an actuality
  - Provides efficient structure for response

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Investigation and corrective action(s):

- Not about placing blame. Structured to identify and correct a deficiency in the implementation process working with hazards.
- If there was a risk assessment or job hazard analysis, investigate the injury (exposure) to the control measure: what failed?
- If no risk assessment, root cause analysis essentially starts with a risk assessment.
  Ref. ANSI B11.0 or ISO 12100.
- Determining what got missed and ensure updates with ‘guardrails’ are made to the risk process and equipment/process itself.

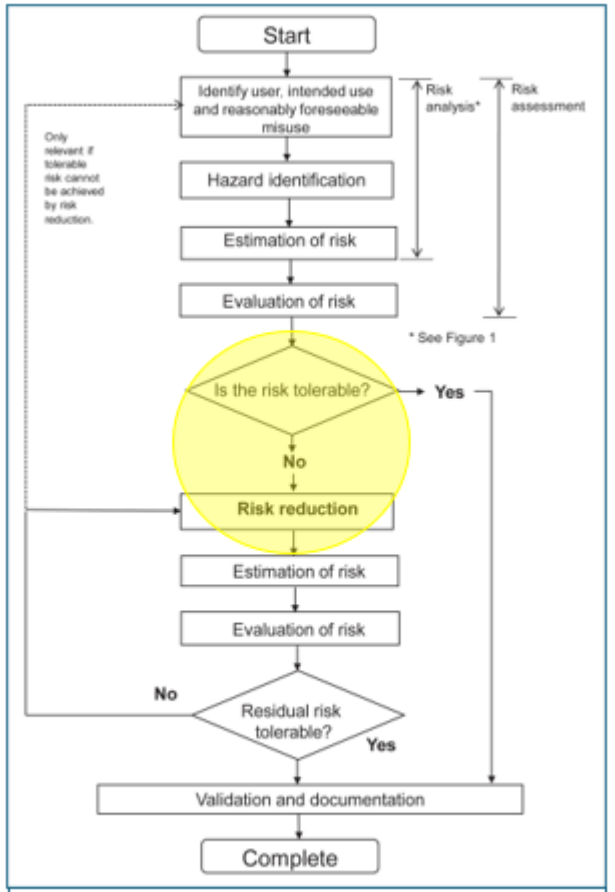

Figure 4: Essential Risk Assessment Process,
Ref. ISO/IEC Guide 51 "Safety aspects — Guidelines for their inclusion in standards"

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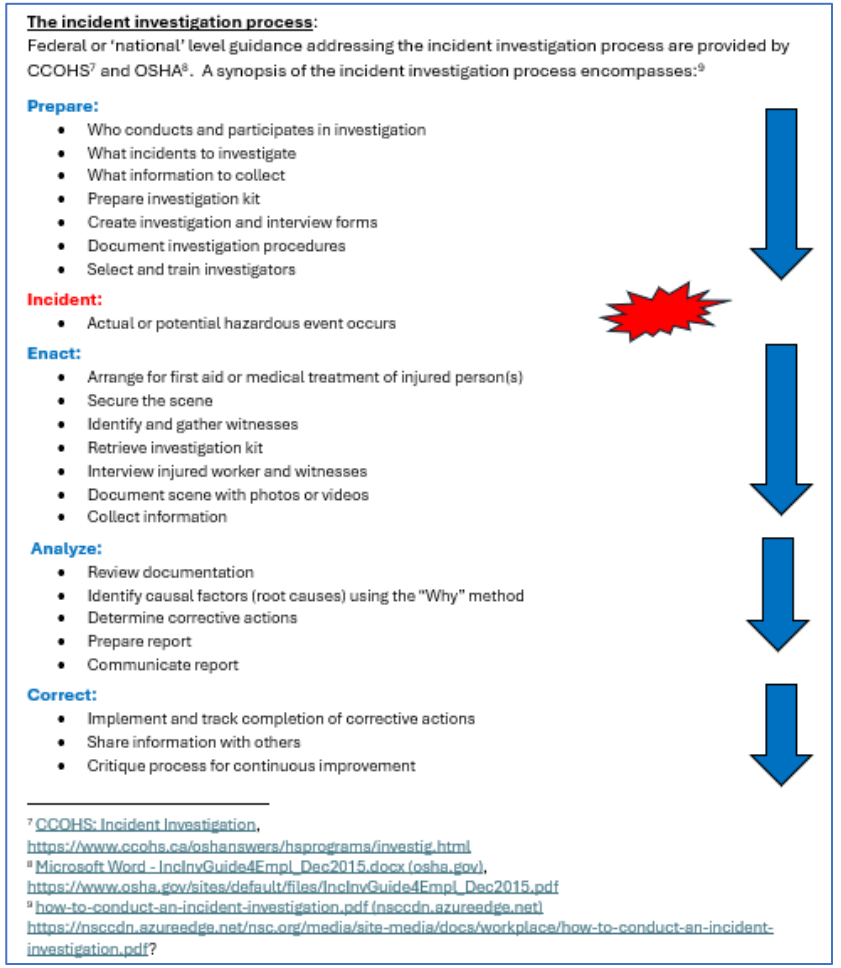
Investigation and corrective action(s):

- Prepare: People, plans, & resources
- Incident: Actual/potential hazardous event
- Enact: Per the plans & training
- Analyze: Review the information – root cause
- Correct: Don't 'band aid the matter' or the problem will arise again elsewhere, putting operations, talent, and profits at risk.
- Safety and profits are NOT mutually exclusive.



The incident investigation process:

Federal or 'national' level guidance addressing the incident investigation process are provided by CCOHS[7] and OSHA[8]. A synopsis of the incident investigation process encompasses:[9]

Prepare:
- Who conducts and participates in investigation
- What incidents to investigate
- What information to collect
- Prepare investigation kit
- Create investigation and interview forms
- Document investigation procedures
- Select and train investigators

Incident:
- Actual or potential hazardous event occurs

Enact:
- Arrange for first aid or medical treatment of injured person(s)
- Secure the scene
- Identify and gather witnesses
- Retrieve investigation kit
- Interview injured worker and witnesses
- Document scene with photos or videos
- Collect information

Analyze:
- Review documentation
- Identify causal factors (root causes) using the "Why" method
- Determine corrective actions
- Prepare report
- Communicate report

Correct:
- Implement and track completion of corrective actions
- Share information with others
- Critique process for continuous improvement

[7] CCOHS: Incident Investigation, https://www.ccohs.ca/oshanswers/hsprograms/investig.html
[8] Microsoft Word - IncInvGuide4Empl_Dec2015.docx (osha.gov), https://www.osha.gov/sites/default/files/IncInvGuide4Empl_Dec2015.pdf
[9] how-to-conduct-an-incident-investigation.pdf (nsccdn.azureedge.net) https://nsccdn.azureedge.net/nsc.org/media/site-media/docs/workplace/how-to-conduct-an-incident-investigation.pdf?

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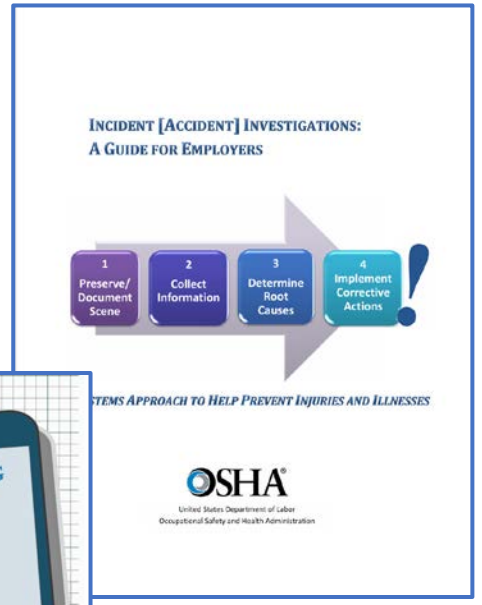
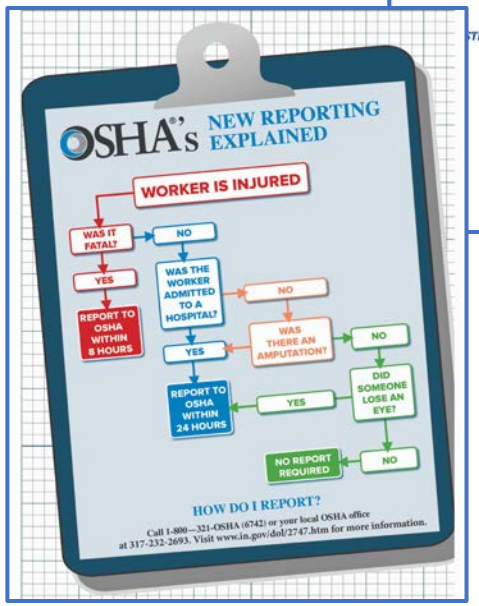
About that incident…

- Need (at least) better guidance (if not forms) in consensus standards: more than a casual ref.
- Determined that for laser materials processing (hot work) in lab environments & manufacturing, closest relatable consensus standard for NBHs is AWS Z49.1 or CSA W117.2.
- Incident investigation & reporting is a discipline unto itself and should not be treated lightly. Training is recommended/required.





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About that incident…

- Regarding being in close proximity to industrial LGACs:
  - Respiratory protection is required & familiar territory
  - Face (beam, LTIR, and spatter) protection
  - Eye protection? Does one need to double up (LPE & face shield)?
    - From experience and buried within AWS Z49.1 7 CSA W117.2 (perhaps could be more clearly stated, especially for new market segment of HLDs in MP), unless risk assessment determines otherwise → **YES!**
    - Particulates can ingress past the face shield and settle on cornea impacting operator potentially scratching/marking it (cold or hot particles).
  - Informative guidance on baseline filtration/protective levels respective of the process and materials involved.

Double protection is advertised.
But does it deliver for application?
Eye goggles + face shield is what is noted per AWS, CSA, & IIW.

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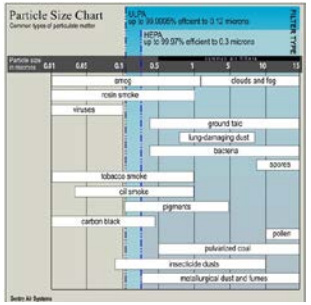
About that incident…

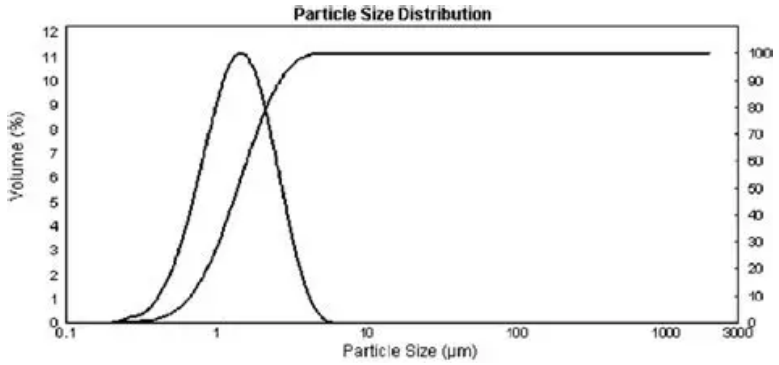
- Regarding being in close proximity to industrial LGACs: Respiratory
  - Isn't there sufficient 'nominal' data on the particulate profile respective of the processes?
  - Cannot there be informative guidance on respiratory specification criteria?
  - For the industrial sector, guidance is possible.

Image: Honeywell 7700 series half-mask respirator

Filter MERV Rating	Average Particle Size Efficiency (µm)	
6	3.0 to 10.0	49.9%
8	3.0 to 10.0	84.9%
10	1.0 to 3.0 3.0 to 10.0	50% to 64.9% 85% or greater
12	1.0 to 3.0 3.0 to 10.0	80% to 89.9% 90% or greater
14	0.3 to 1.0 1.0 to 3.0	75% to 84% 90% or greater
16	0.3 to 1.0	75% or greater
HEPA	0.3	99.97%



MERV (Minimum Efficiency Reporting Value)	Composite Average Particle Size Efficiency, % in size, µm			Average Arrestance, %	Size of Contaminant that can be captured
	0.3-1.0	1.0-3.0	3.0-10.0		
1	-	-	20% or better	65% or Less	Lint
2	-	-	20% or better	65% - 69%	Pollen
3	-	-	20% or better	70% - 74%	Bugs
4	-	-	20% or better	75% or Greater	Sanding Dust
5	-	-	20% - 34%	-	Cement Dust
6	-	-	35% - 49%	-	Mold Spores
7	-	-	50% - 69%	-	Gelatin
8	-	20% or better	70% or better	-	Powder
9	-	35% or better	75% or better	-	Milled Flour
10	-	50% - 64%	80% or better	-	Auto
11	20% or better	65% - 79%	85% or better	-	Emissions
12	35% or better	80% or better	90% or better	-	Welding Fumes
13	50% or better	85% or better	90% or better	-	Bacteria
14	75% - 84%	90% or better	95% or better	-	Tobacco
15	85% - 94%	90% or better	95% or better	-	Smoke
16	95% or better	95% or better	95% or better	-	Talcum Dust



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Incident Report Forms (Summary):

- Integration with workplace OHS program:
  - Rapid intake with the essentials
  - Facilitates more comprehensive assessment with determinations, action plan, and follow up.
  - Level of effort & details commensurate with the risk potential not just actual injury alone.
  - Provides a feedback loop for continuous improvement and validation of the facility OHS & written Laser Safety program.
  - Working through incident planning and relating back to the risk assessment will identify any gaps if the workplace safety program – enabling closure.

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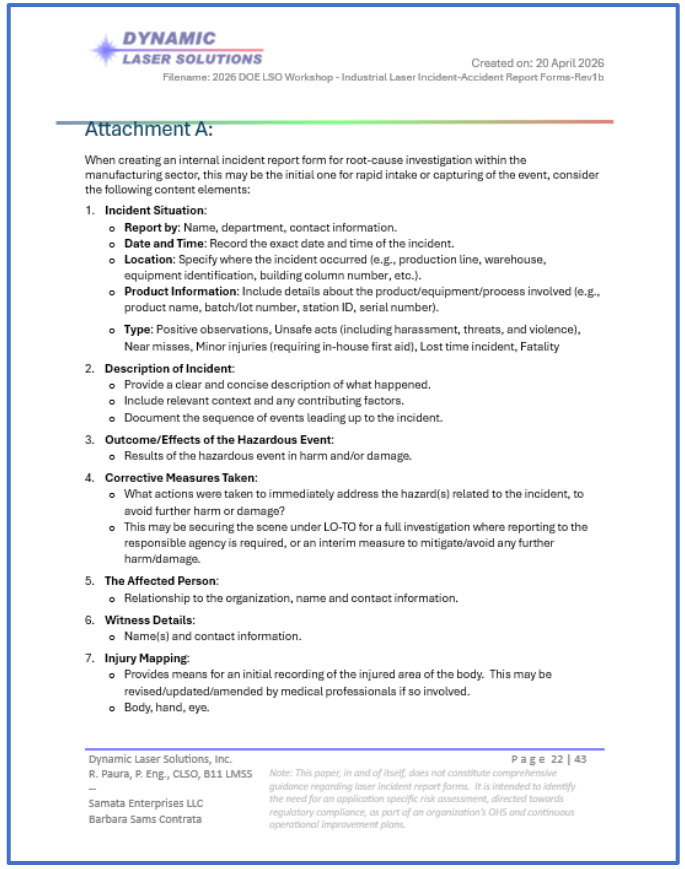
Incident Report Forms (Summary): An informative baseline



DYNAMIC LASER SOLUTIONS

Created on: 20 April 2026
Filename: 2026 DOE LSO Workshop - Industrial Laser Incident-Accident Report Forms-Rev1b

Attachment A:

When creating an internal incident report form for root-cause investigation within the manufacturing sector, this may be the initial one for rapid intake or capturing of the event, consider the following content elements:

1. **Incident Situation**:
   - **Report by**: Name, department, contact information.
   - **Date and Time**: Record the exact date and time of the incident.
   - **Location**: Specify where the incident occurred (e.g., production line, warehouse, equipment identification, building column number, etc.).
   - **Product Information**: Include details about the product/equipment/process involved (e.g., product name, batch/lot number, station ID, serial number).
   - **Type**: Positive observations, Unsafe acts (including harassment, threats, and violence), Near misses, Minor injuries (requiring in-house first aid), Lost time incident, Fatality
2. **Description of Incident**:
   - Provide a clear and concise description of what happened.
   - Include relevant context and any contributing factors.
   - Document the sequence of events leading up to the incident.
3. **Outcome/Effects of the Hazardous Event**:
   - Results of the hazardous event in harm and/or damage.
4. **Corrective Measures Taken**:
   - What actions were taken to immediately address the hazard(s) related to the incident, to avoid further harm or damage?
   - This may be securing the scene under LO-TO for a full investigation where reporting to the responsible agency is required, or an interim measure to mitigate/avoid any further harm/damage.
5. **The Affected Person**:
   - Relationship to the organization, name and contact information.
6. **Witness Details**:
   - Name(s) and contact information.
7. **Injury Mapping**:
   - Provides means for an initial recording of the injured area of the body. This may be revised/updated/amended by medical professionals if so involved.
   - Body, hand, eye.

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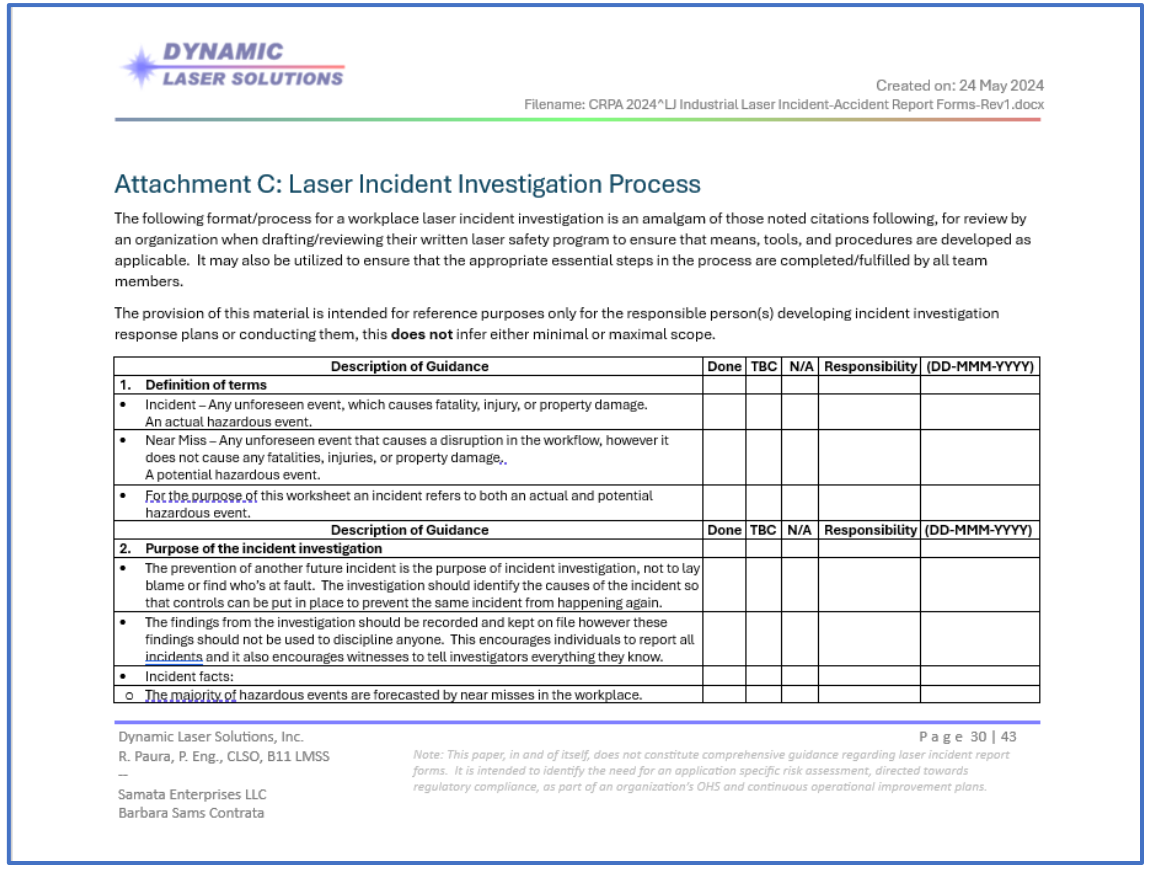
R. Paura, P. Eng., CLSO, B11 LMSS
--
Samata Enterprises LLC
Barbara Sams Contrata

Note: This paper, in and of itself, does not constitute comprehensive guidance regarding laser incident report forms. It is intended to identify the need for an application specific risk assessment, directed towards regulatory compliance, as part of an organization's OHS and continuous operational improvement plans.



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Created on: 24 May 2024
Filename: CRPA 2024^LJ Industrial Laser Incident-Accident Report Forms-Rev1.docx

Attachment C: Laser Incident Investigation Process

The following format/process for a workplace laser incident investigation is an amalgam of those noted citations following, for review by an organization when drafting/reviewing their written laser safety program to ensure that means, tools, and procedures are developed as applicable. It may also be utilized to ensure that the appropriate essential steps in the process are completed/fulfilled by all team members.

The provision of this material is intended for reference purposes only for the responsible person(s) developing incident investigation response plans or conducting them, this **does not** infer either minimal or maximal scope.

Description of Guidance	Done	TBC	N/A	Responsibility	(DD-MMM-YYYY)
1. Definition of terms					
• Incident – Any unforeseen event, which causes fatality, injury, or property damage. An actual hazardous event.					
• Near Miss – Any unforeseen event that causes a disruption in the workflow, however it does not cause any fatalities, injuries, or property damage,. A potential hazardous event.					
• For the purpose of this worksheet an incident refers to both an actual and potential hazardous event.					
Description of Guidance	**Done**	**TBC**	**N/A**	**Responsibility**	**(DD-MMM-YYYY)**
2. Purpose of the incident investigation					
• The prevention of another future incident is the purpose of incident investigation, not to lay blame or find who's at fault. The investigation should identify the causes of the incident so that controls can be put in place to prevent the same incident from happening again.					
• The findings from the investigation should be recorded and kept on file however these findings should not be used to discipline anyone. This encourages individuals to report all incidents and it also encourages witnesses to tell investigators everything they know.					
• Incident facts:					
○ The majority of hazardous events are forecasted by near misses in the workplace.					

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Basic incident report form: (4-page example, provided)

- 4-page guidance (intro)
- Can be customized
- Drawn from agencies here in Canada (NWT, Nunavut & Ontario)
- ---
- ? Other guidance docs for incident reporting and investigation?

Attachment B: Example initial incident report form

1. Incident Situation:	
Reported by:	Department:
Email:	Phone: Ext:
Date of occurrence:	Approx. time of occurrence:
Exact location (equipment ID, plant location):	

- ☐ Positive observation(s),
- ☐ Unsafe act(s) (including harassment, threats, and violence),
- ☐ Near misses,
- ☐ Minor injuries (requiring in-house first aid),
- ☐ Lost time incident,
- ☐ Fatality

2. Description of Incident:

Provide a clear and concise description of what happened. Include relevant context and any contributing factors. Document the sequence of events leading up to the incident.

3. Outcome/Effects of the Hazardous Event:

Results of the hazardous event in harm and/or damage.

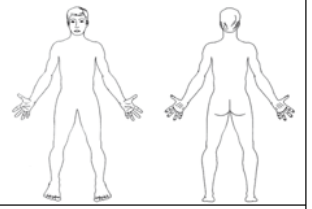
4. Corrective Measures Taken:

What actions were taken to immediately address the hazard(s) related to the incident, to avoid further harm or damage?
This may be securing the scene under LO-TO for a full investigation where reporting to the responsible agency is required, or an interim measure to mitigate/avoid any further harm/damage.

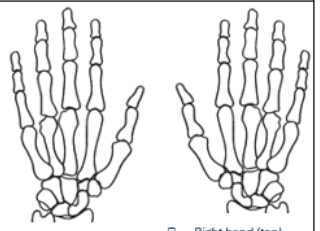
7. Injury Mapping:

Provides means for an initial recording of the injured area of the body.
This may be revised/updated/amended by medical professionals if so involved.

Body:
What part of your body did you injure? (left/right side, hand, eye, back, etc.)
Please also indicate the body part on the diagram.

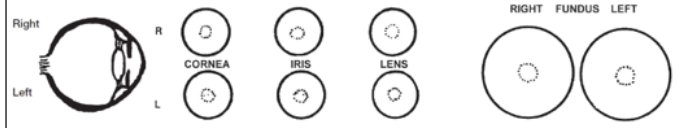


Hand:
Which hand is injured?
☐ Left
☐ Right
Which is the dominant hand?
☐ Left
☐ Right
Other information



☐ *Left hand (top)* ☐ *Right hand (top)*
☐ *Right hand (bottom)* ☐ *Left hand (bottom)*

Eye:
Identify what portion of the eye was (or suspected to be) injured?
Circle and mark applicable areas. May be amended by attending physician.



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Paper and example attachments:

- 43-page paper, referencing the need with an example for effective incident report forms and their role with investigation.
- Attachment A: Content Considerations for Incident Report Forms.
- Attachment B: Incident Report Form – General, with Injury Mapping.
- Attachment C: Laser Incident Investigation Process.
- Attachment D: Laser Incident Investigation Report Structure.
- Attachment E: Summary Canada OHS Information Links.
- Attachment F: Summary US OSH Information Links.

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Conclusion:

- *Apparent* 'gap' with consensus safety standards identifying the need for foundational work – risk assessment or job hazard analysis – when discussing incident reporting and investigation.
- *Fortunately*, many OHS agencies provide snapshot guidance on elements for this. But sectors need to complement this effort with adoption, recommendations, and guidance in their technical documents and standards.
- Don't need to 'invent from scratch' *but* do need to walk through potential incident(s) and prepare accordingly.
- *Recommend*: Federal agencies (CCOHS & OSHA) for the foundation and core, check and update per JHA agency requirements for the fine tuning and details.
- *Note*: Canadians can have online access/viewing of CSA Z1005 "*Workplace Incident Investigation*".

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‘In the cloud’:

- Accessible until 31 May 2026
- Presentation
- Paper
- LSO Support Files (Incident Report Forms)
  - Canada
  - EU OSH Wiki
  - ILO
  - UK HSE
  - US OSHA

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- **L**ight
- **A**pplied
- **S**afely,
- **E**fficiently &
- **R**eliably

Appreciation to: Barbara Sams Contrata, Samata Enterprises for executive review
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Laser Incident Report Forms - Manufacturing

Crib Sheet: U.S.

- Homework: revisit OSHA guidance on injury reporting
- US OSHA |Recordkeeping | Occupational Safety and Health Administration
  Incident report forms: Check with your JHA for regulatory reporting form, if applicable, repurpose for internal documentation or utilize example provided
- Work through potential laser injury response: includes potential injury/injuries and treatment(s), what records are provided by medical facility for investigation
- Incident investigation: revisit OSHA guidance on incident investigation
  US OSHA | Incident Investigation - Overview | Occupational Safety and Health Administration
- Incident investigation process and forms: utilize checklists provided as appropriate
- Additional support:
  - Investigating accidents and incidents: A workbook for employers, unions, safety representatives and safety professionals HSG245 (hse.gov.uk)
  - The Importance of Root Cause Analysis During Incident Investigation (OSHA)
  - US OSHA – Incident Investigation Guide 4 Employers (Dec2015)

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Laser Incident Report Forms - Manufacturing

Crib Sheet: Canada

- Homework: revisit CCOHS guidance on injury reporting
  CCOHS: Health and Safety Legislation in Canada - Injury Reporting
- Incident report forms: Check with your JHA for regulatory reporting form, if applicable, repurpose for internal documentation or utilize example provided
- Work through potential laser injury response: includes potential injury/injuries and treatment(s), what records are provided by medical facility for investigation
- Incident investigation: revisit CCOHS guidance on incident investigation
  CCOHS: Incident Investigation
- Incident investigation process and forms: utilize checklists provided as appropriate
- Additional support:
  - Investigating accidents and incidents: A workbook for employers, unions, safety representatives and safety professionals HSG245 (hse.gov.uk)
  - Preparing for a Workplace Incident Investigation Using CSA Z1005 - Overview (csagroup.org)
  - CSA Z1005:21 | Product | CSA Group

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