Injury during machining work and preventive measures against the recurrence of the accident

Kotaro BESSHO¹, Koji KIRIYAMA², Yoshihiro NAKANE¹, Yukihiro MIYAMOTO¹, Tetsuro ISHII¹, J-PARC Center¹ / CROSS², Japan
- Injury during machining work
- Direct causes and problems leading to the incident
- Root causes leading to inadequate actions
- Preventive measures against the recurrence of the accident (Various efforts for safety)
Injury during machining work using a milling machine

The accident occurred in manufacturing small parts for magnetic-field measurements using a milling machine.

Injured person: a contractor worker (leader of the team)
The injured worker-A was brushing off the machining dust by hand with wearing gloves.

His middle finger of the right hand was caught in the rotating mill and got serious injury.
The worker did not stop the rotation of the machine.
He tried to remove dust with hand, not using tools (brush, air...)
He engaged in the machining work putting on the gloves.

These procedures violate the regulations.
- The company of the worker received a corrective instruction from the Labor Standard Inspection Office.

Team members could not caution the injured worker, although they noticed he used a milling machine wearing gloves.

Root causes of the incident and the preventative measures investigated by the working group
interview, inspection, analysis, discussion
Important root causes leading to inadequate actions

1) Lack of concentration on the work

Insensitive Tool Box Meeting (TBM)
Unclear task for each worker

- The injured worker-A (leader) planned to let another worker-B to do the machining work. However in the TBM, the assignments of the tasks to each member was not enough confirmed.

- Just before starting the machining work, the worker-B hesitated to use the milling machine, thus the worker-A did the machining work by himself.

- The worker-A intended that he only attached an endmill (cutting tool) to the milling machine wearing gloves. Before starting the machining work, he forgot to take off the gloves.

- The team members (including A) could not stop their own works when their roles were changed.

⇒ Insufficient readiness before starting the work
2) Insufficient skill for safety confirmation

2-1) **Confirmation of wearing basic safety equipment (not wearing gloves) was not developed into habit.**

2-2) Other **team members (B,C,D) could not caution the worker-A**, although they noticed the worker-A kept wearing gloves during the machining work.

**Insufficient recognition of danger**

*Other team members knew that wearing gloves are prohibited.*

*However they could not imagine a serious result caused by this violation.*
1) In the TBM, a work manager (J-PARC staff) must confirm

✓ Tasks are clearly assigned to each worker.
✓ The (supervisory) foreman does not engage in the high-risk works*.

*High-risk works: Mistakes in work procedures / operation lead to serious incidents, such as occupational accidents, fire, radiation exposure, radioactivity release, etc.

(examples of *high-risk works)
- machining work, crane operation, electrical insulation works,
- handling radioactivated materials

In these high-risk works, the work manager must have the worker concentrate his/her work.
2-1) Introducing the **Dress Code** and applying to all workplaces - the rule for safety equipment defined at each workplace
2-2) Continuation and developments of the hazard training based on experience since FY2016

More than 70% of 400 J-PARC staffs already took this training.

J-PARC’s new rule: All work managers must take this training.
Improving **safe working environments** at workshops

- Preparation of machines, places, equipment for safe works
- Setting directions, manuals, checklists at workplaces
- Confirming clothes, protectors for oneself and others

**Good examples at a common use workshop**

- Mirror for checking safety equipment
- Safety glasses on hand

**Directions for handling each machine tool**

- Close wristband of the clothes.
- Bind long hair. / Put on working cap.
- Don’t use waste cloth for removing the machining dust (brush, air ..)

**Directions for the workers on the entrance door of the room**

- Safety glasses: OK!
- No gloves: OK!
Regulating matters required for safe works and guidelines

Preparing the rulebook for safety in machining work, which must be followed by all the J-PARC members.

Providing basic directions, manuals, checklists, and education materials for improving safety in machining works

Mutual inspection of workplaces and machines; Technical suggestions to the workplace managers
Other efforts for safety at J-PARC

Since FY2015 (after the fire)

Work manager (*1): Site manager (*2):

(*1) A J-PARC staff member who is in charge for the work.
(*2) A J-PARC staff member or a contractor who is in charge for the work place.

Placing an order
- Make the contractor to provide the necessary documents to confirm the safety of equipments.
- Confirm the safety with the provided documents.

Training and Information sharing
- It is important to make workers obtain necessary knowledge about their work and is insufficient to do too formal training.
- The work manager and the site manager should have necessary knowledge and awareness on their responsibility.
- The work manager should confirm site manager’s ability to manage the work safely.

Work planning
- The safety of work should be confirmed by each division, not a work manager alone. Especially, works corresponding to the 3H keywords (Hajimete, Henko, Hisashiburi: First time work, Changing work process, Work after long term break) should be paid special attention.
- The division should check the safety of the work under their own responsibility. The work with potential risks, like an on-site test of equipment without a facility test, should be confirmed in the Division Safety Review Meeting.
- The work manager should check the contractor’s work plan and make the contractor revise the plan if necessary.
- It is the section leader that approves finally the work plan with reducing the risk.
- Risk analysis is not only the evaluation of major risks. Investigating various potential risks in the processes is...
In the **3H keywords** situations, **Hajimete** : First time, **Henko** : Changing, **Hisashiburi** : After a long interval, special attention must be payed.

*3H keywords (Hajimete, Henko, Hisashiburi: First time work, Changing work process, Work after long term break) should be paid special attention.*

- The division should check the safety of the work under their own responsibility. The work with potential risks, like an on-site test of equipment without a facility test, should be confirmed in the Division Safety Review Meeting.
- The work manager should check the contractor’s work plan and make the contractor revise the plan if necessary.
- It is the section leader that approves finally the work plan with reducing the risk.
- Risk analysis is not only the evaluation of major risks, Investigating various potential risks in the processes is
Other efforts for safety at J-PARC

5. Clarifying Risks

6. Overseeing the Workers

7. Supervising Works and Risks

8. Suspend the work in case of Changing Original Plan etc.

9. Reviewing Today’s Work

Process Schedule Meeting etc.
- The section leader should examine risks and conflicts in the points of view of various interference (time, location, tools, worker schedule etc.) with other works. The section leader should change the plan if necessary. When the work plan is changed, it should be informed to all the persons concerned.

Daily Meetings etc.
- All potential risks should be informed and shared between all workers.
- Risks and improvements noticed in the meetings should be reflected to the future works and work planning.

Supervising and Checking Works
- The site manager should continuously supervise workers.
- The work manager should continually monitor the working safety.
- The section leader should check that the work and the risks are controlled and managed appropriately.
- When a new equipment will be installed, the work manager should check the interfering risks with existing equipment.

Changing Original Plan, Stop Work etc.
- If unexpected procedures are required, abnormal situations are suspected, or another worker including outside persons points out that the work procedure is dangerous, the site manager must stop the work process.
- If suspicious risk are revealed, return to the work planning stage.
- Before resuming the work process, work manager’s admission is required.

Reporting and Improvements
- The site manager should list the status of risks on a job diary and improve the risk management framework.
Other efforts for safety at J-PARC

- Unexpected procedures required
- Abnormal situations suspected
- Another worker points out that the process is dangerous

The site manager must stop the work process.

Changing Original Plan, Stop Work etc.
- If unexpected procedures are required, abnormal situations are suspected, or another worker including outside persons points out that the work procedure is dangerous, the site manager must stop the work process.
- If suspicious risk are revealed, return to the work planning stage.
- Before resuming the work process, work manager’s admission is required.

Reporting and Improvements
- The site manager should list the status of risks on a job diary and improve the risk management framework.
Other efforts for safety at J-PARC

“Mindful of Others” since FY2016

Mindful of others

Speak out, if you find an act of danger!

- Certainly wear protectors (helmet, safety shoes, etc.).
- Be sure that you hook your safety belt on a support.
- Do not stand on a stepladder.
- Do not stay under heavy loads.

Thank you. That was close.

Your attention saves others.
Other efforts for safety at J-PARC

Safety Information Exchange Meeting inside J-PARC since 2017 (held in the Safety-Day around 5.23)

Award for good practices from the director Talk on safety works at a facility

Symposium on Safety in Accelerator Facilities since 2013
- to share information on safety issues between various institutions
- 100-150 participants from accelerator facilities, universities in Japan

(Topics) High-press. / Cryo. gas; Emergency response; Electrical safety; Heavy load transportation; Fire safety, etc.

Invited speakers from the ITSF community introduced Japanese workers precious works!

Courtesy: R. Trant (CERN), Y. Loertscher (PSI), C. Balle (CERN), A. Manzlak (J-Lab), F. Saretzki (DESY)
Summary

Strengthening of safety measures at J-PARC

- Confirmation of assignments of the tasks for the workers
- Application of the Dress Code at workplaces
- Hazard training based on experience
- Improving safe working environments
- Expert group on machining work
  (Preparing documents for safe machining works, inspection of workplaces, technical suggestions)
- Other efforts (Work Flow Standard, Mindful of Others, Sharing information)