FUSE HEADS INCIDENTS

SAFEX Closed Day

Initiating Systems Session

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Fuseheads (FH's)

are known to be sensitive to (amongst other stimuli)

- friction
- impact
- static discharge

What happened?	When did it happen ?
three accidents without and with injuries have occurred during manufacturing of FH's at the three difference workplaces	During relatively short period - on Jun 2th 2005, - on Feb 9th 2006 - on Feb 17th 2006

Everything without obvious causes !!

Injuries

- The first incident happened without injury
- During the second and the third accidents the line operators suffered burns to face, neck and right hand requiring hospitalization of 1 and 3 weeks.

Incident 1st
JUN 2, 2005 – ASSEMBLY LINE

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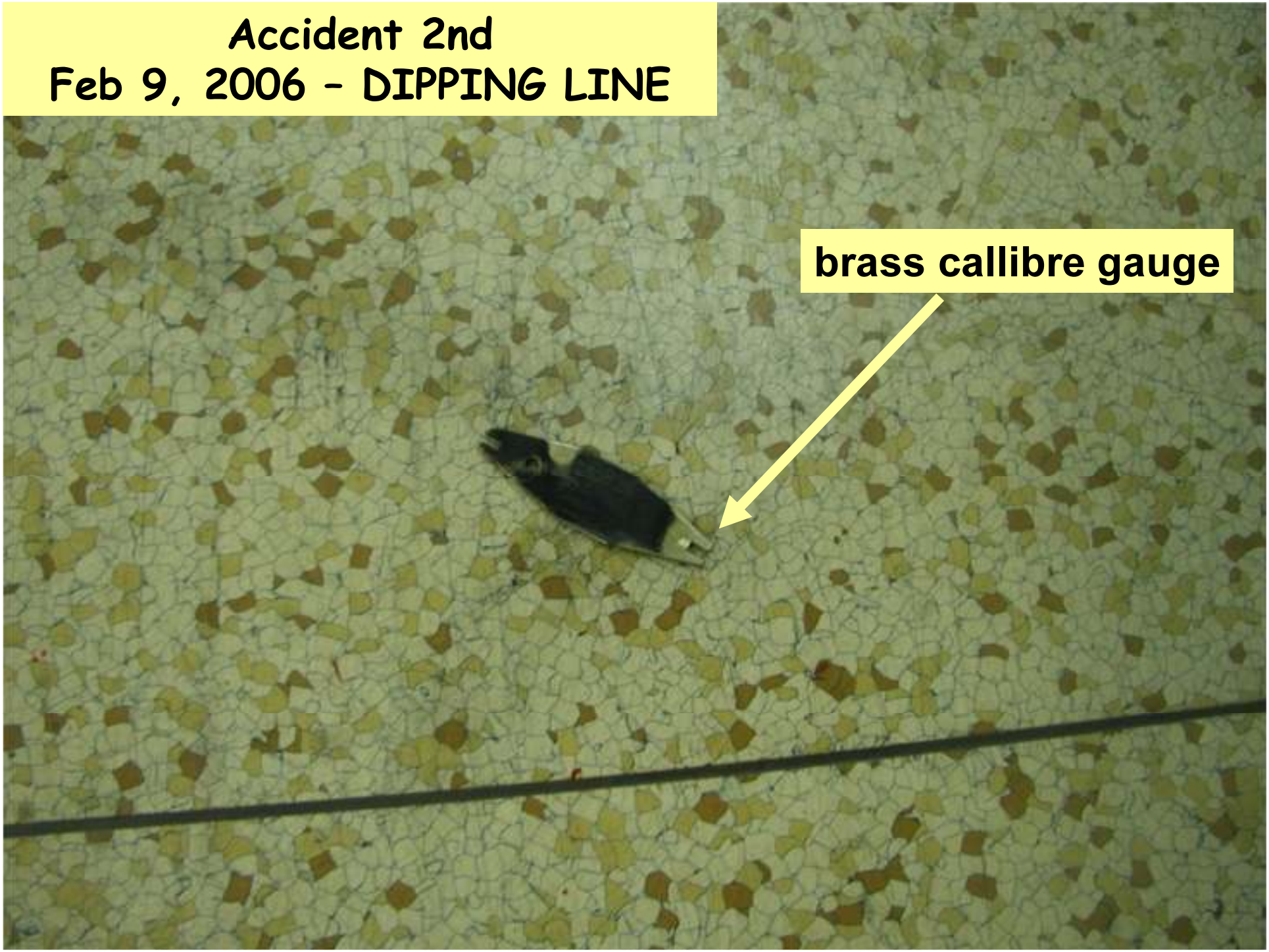
Accident 2nd
Feb 9, 2006 – DIPPING LINE

Accident 2nd
Feb 9, 2006 – DIPPING LINE



Accident 2nd
Feb 9, 2006 – DIPPING LINE

Accident 3rd
Feb 17, 2006 – VISUAL CHECKING

Impact

In addition to the painful injuries
suffered by personnel these incidents
have had
operational impact of the company
because after
the third one
the production was interrupted
for 3 weeks.

Action (1.- 3.)

- **Investigation team took following actions to prevent recurrence and to protect operators:**

1. review risk assessment of the whole process of FH's production. Each previous and followed operation or handling to analyze in deep detail
2. operators to fit shields at the most hazardous operations
3. to fit workplaces (where it's possible) with protective screens


LAYOUT - BEFORE INCIDENT


LAYOUT - AFTER INCIDENT
bad practice
SAFETY IS OUR FIRST PRIORITY


LAYOUT – AFTER INCIDENT
good practice
SAFETY IS OUR FIRST PRIORITY

Action (4.- 8.)

4. all workplaces of FH's production and assembly line operators to wear conductive wrist straps
5. requiring operators to wear gloves on both hands that do not leave wrists exposed
6. allowed quantity of explosives to cut down
7. packing of FH's to change
8. training of workers using videorecording from tests

PACKING – BEFORE INCIDENT

2

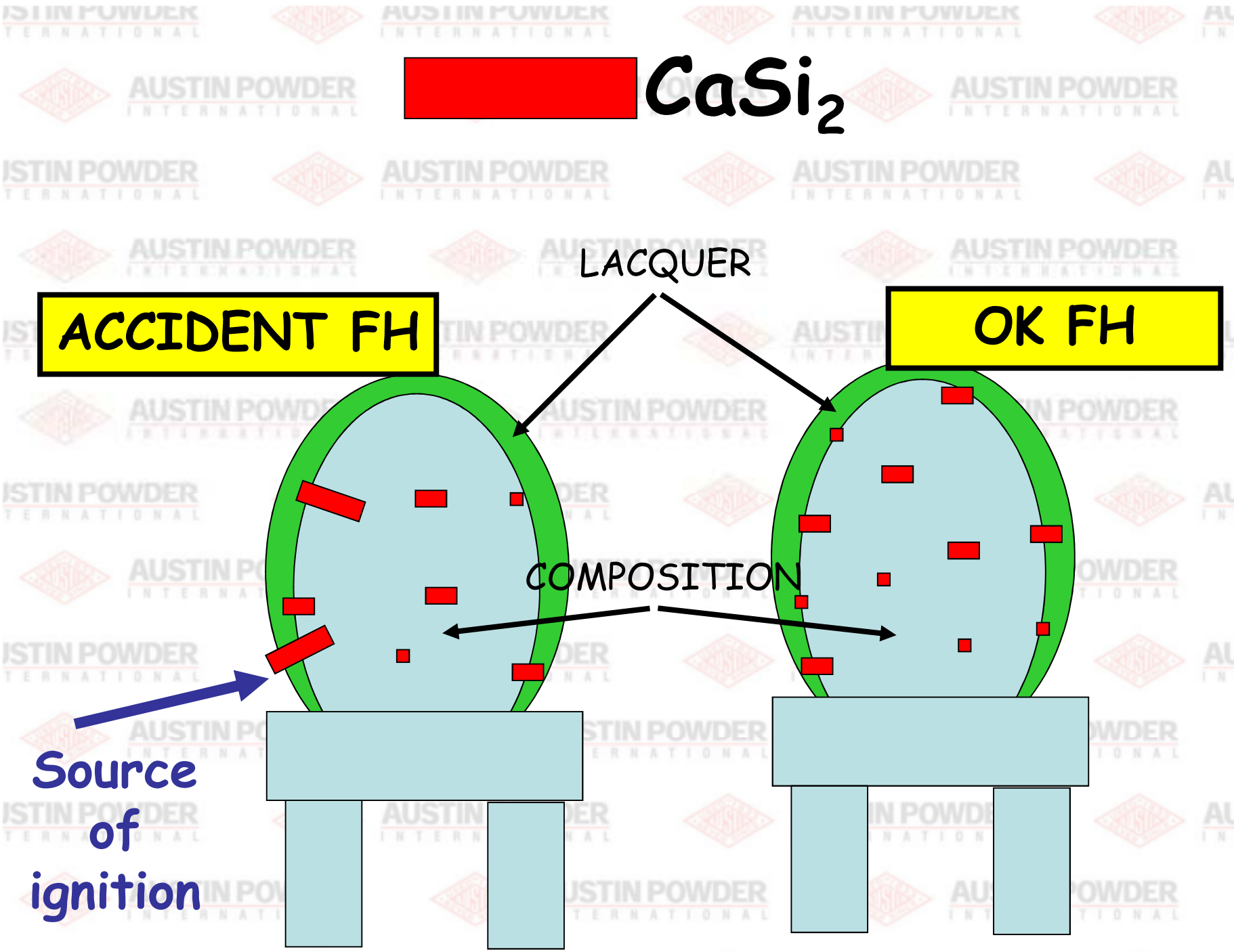
1x 5000 pcs FUSEHEADS

PACKING – AFTER INCIDENT

4x 1000 pcs FUSEHEADS

CAUSE

- Cause of accidents was found as late as two month investigation:
- The raw materials being used at the time included a batch of calcium silicide, which on detailed testing proved to be significantly coarser than normal. Microscopic examination indicated that the FH's made using this coarser material had "bumps" on their surface. It is felt that these "bumps" could have increased the sensitivity of the fusehead composition by interfering with the robustness of the lacquer coating.


$CaSi_2$
LACQUER
ACCIDENT FH
OK FH
COMPOSITION
Source of ignition

Learning (1.- 4.)

1. Be careful at every change of lot or suppliers of raw materials
2. Existing standards of many years and observed specifications and rules didn't catch new issue (new quality of raw material)
3. PPE must be chosen and proof tested to provide protection in the worst-case foreseeable situation
4. Quantities of material in process must always be minimized

Learning (5.- 7.)

5. Containers of energetic materials should be covered at all times
6. The "knock-on" effect of an ignition in one workstation on other workstations should be evaluated
7. Never say never. Accidents have appeared at the technology in operation since 1989, it means often 16 years getting FH's line into troublefree operation

Learning (8.- 9.)

8. Idea of root cause and the trace leading to the finding of root cause was found in the second "lap" after rigorous repeating tests and analyzes. The root cause didn't appear during the first "lap" of investigation
9. Don't try to solve everything yourself. Be open. Ask external experts for another point of view it's very helpful