EPC Belgium

Incident of a Multiblend Truck during a loading of ANFO causes, analysis, evolution

Ir JACQUET David

SUMMARY OF THE PRESENTATION

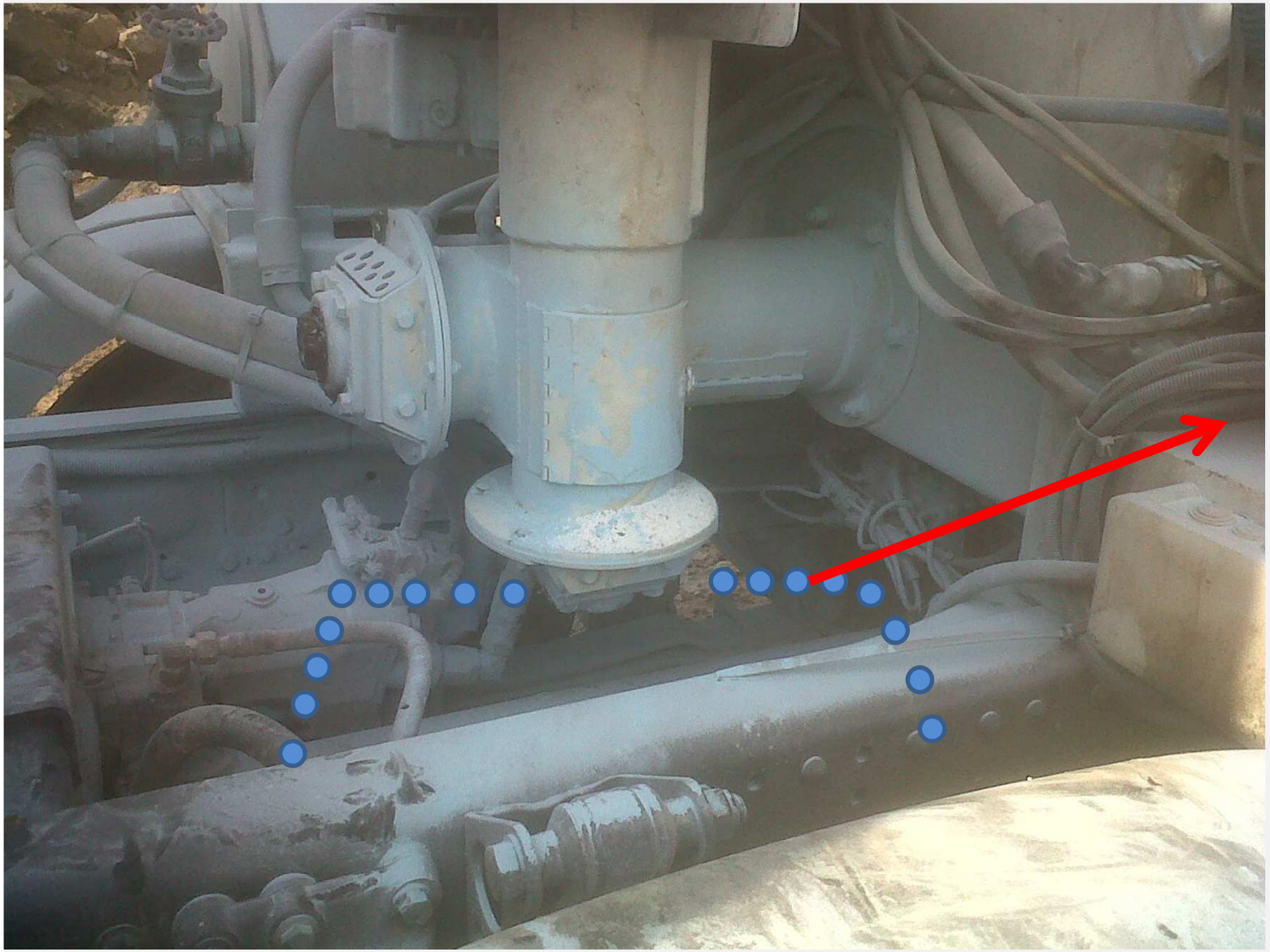
- FACTS
- IMPACTS OF THE INCIDENT
- WHAT HAPPENED
- REPRODUCIBILITY OF THE INCIDENT
- CORRECTIVE ACTIONS
- PREVENTIVE MEASURES
- KEY LEARNING

FACTS

- Location: Limestone quarry in Belgium
- Time: Tuesday, June 19th 2012, at 9:30 am.
- Loading : Multiblend Truck
- Operation in progress: Routine anfo loading.
- Incident description: Production of fumes and glowing particles during anfo loading.

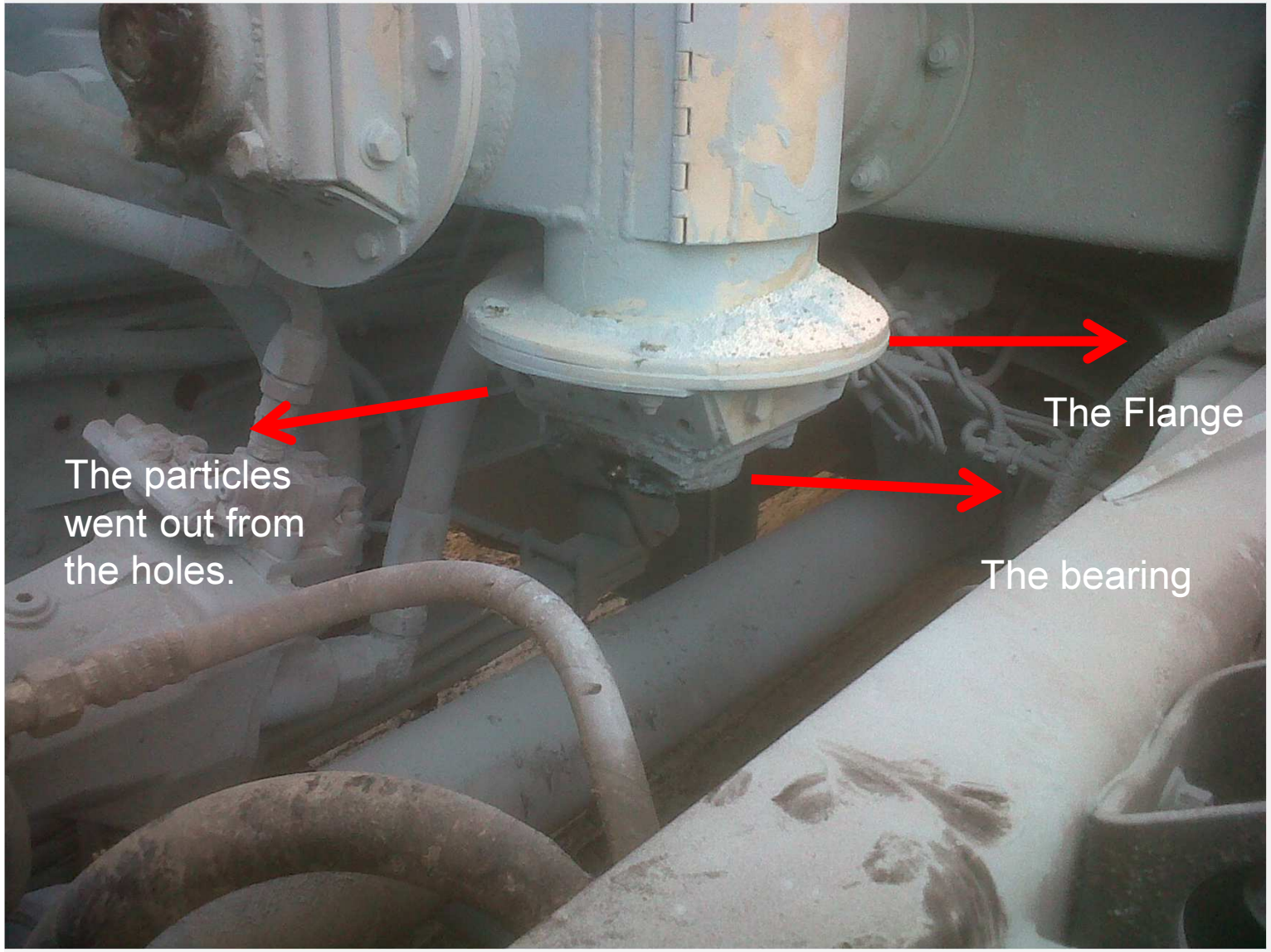
FACTS

FACTS



Glowing particles with light blue smoke.

FACTS


The Flange
The particles went out from the holes.
The bearing

FACTS

Vertical auger with AN (+ Al)

FACTS

- 7:00 Arrival of the Multiblend truck in the quarry
- 8:15 Starting of the production of Heavy anfo with aluminium
- 8:40 Starting of the Anfo production
- Up to 9:30 Normal production except many stop/start due to the blast design.
- Time zero= 9:30 (Still 18 boreholes to complete) *sound similar to "wet banger".* David Jacquet and the Multiblend Operator (driver) have seen fumes and glowing particles from the bottom of the Multiblend truck vertical auger .
  1. 5 to 10 seconds for cut off the engine and the augers
  2. 1 to 2 mn= *Time to extinguish the fire with 1 extinguisher present on the body , easy to extinguish". Time lost for finding the extinguisher due to stress. Quarry employees live the area during extinguishing phase. The 2 EPC Belgium employees are with the Multiblend truck and handling the fire extinguisher .*
  3. about 30 seconds = *Time to move the truck away from the loading area at 50 meters in order to secure the area-*
  4. *about 5 mn = Time to cool the bottom of the vertical auger with water under pressure.*
- 9:38 Give the alert by phone to EPC Belgium

FACTS

- **Combustion:** No particlar smell, light Blue color fumes, Neither ammoniac odor, neither rubber odor. Location of the combustion at the bottom of the vertical auger just above the bearing and below the flange.

- **Maintenance:**
  - Bearing of the vertical auger replaced on July 2011.
  - Gasket seal not changed on July 2011 (original one in 2009)
  - Greasing of the bearing had been done 2 weeks before.
  - Rest of grease had been found at the peripheral of the bearing but not with the balls inside the bearing .

- **Operation conditions:** Many stop and start but usual situation.

- **Chemical aspect:** Presence of aluminium/AN inside the auger, above the bearing, between the bearing and the gasket seal.

IMPACT OF THE INCIDENT

- **No injuries**

- **Small damage of the Multiblend truck**

  replacement of seal and bearing

- **For the miners and operator : a bad memory**

LIKELY CAUSE OF INCIDENT

- The principal cause of this incident was a lack of tightness of the seal in the vertical auger.

- This lack of tightness comes from the design of this auger ,but also we have to note a lack of good housekeeping and preventive maintenance rules.

LIKELY CAUSE OF INCIDENT

- Fumes and particles glowing went out from an area just below the flange and above the bearing

- The gasket seal is in rubber and is worn and deformed. This seal is the original one mounted in 2009. The bearing has been changed in July 2011.

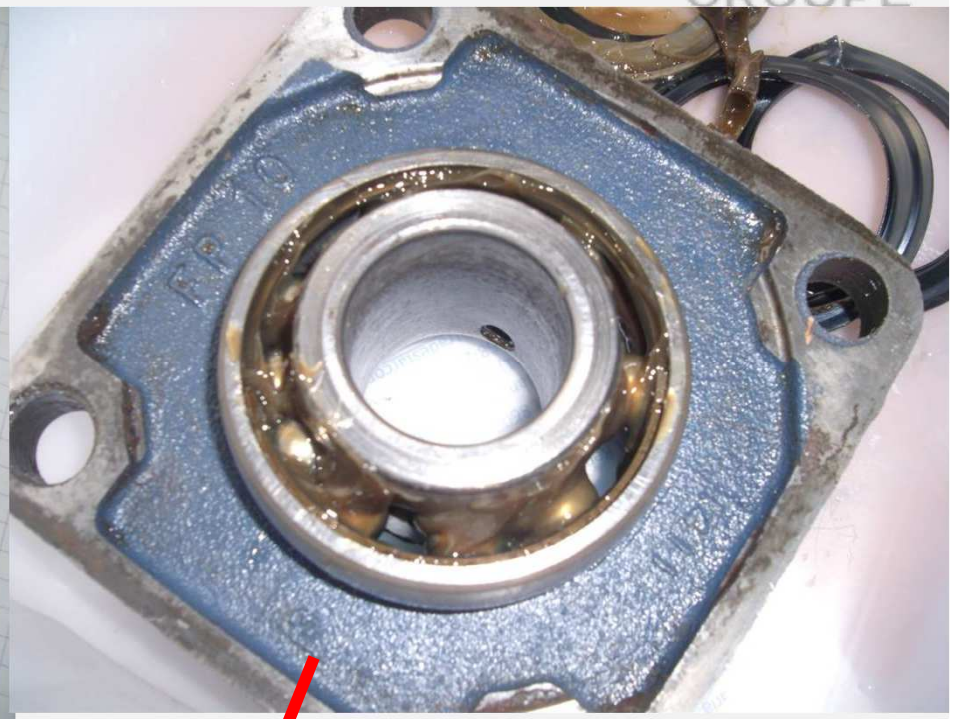
- An accumulation of fine particles (aluminium, nitrate) in contact with grease in the confined chamber had been discovered in the bearing. This confinement has increased the friction and reduced heat dissipation. Heat source by friction was located inside the bearing (ball bearings) at the bottom of vertical auger.

- The presence of the shaft guard on the bearing and the lack of cleaning allowed the accumulation of energetic product within the bearing.

Pictures of the gasket seal

- **<u>Gasket seal located below the flange and above the bearing on the bottom of the vertical auger:</u>** The seal is deformed which leaves the solids to fall down up to the bearing.

Pictures of the balls



- **<u>Ball Bearing concerned by the incident:</u>** The balls are worn. Absence of grease at all. Balls are yet greased for life .

- **<u>New Ball Bearing:</u>** The balls are surronded by grease and looks new.

LIKELY CAUSE OF INCIDENT

- The bearing is becoming jammed due to the presence of ammonium nitrate, aluminium on the balls.
- The bearing was jammed and the hydraulic motor had obliged the bearing to run forcing him to be overheated at high temperature. We are sure of that due to an appropriate observation of the bearing.
- The overheating phenomena has initiated a combustion seen by the operators as fumes and glowing particles.

WHAT HAPPENED

The factors making possible the production of fumes and glowing particles are:

1. Energetic materials as aluminium when in contact (water, rust, ammonium nitrate, grease).

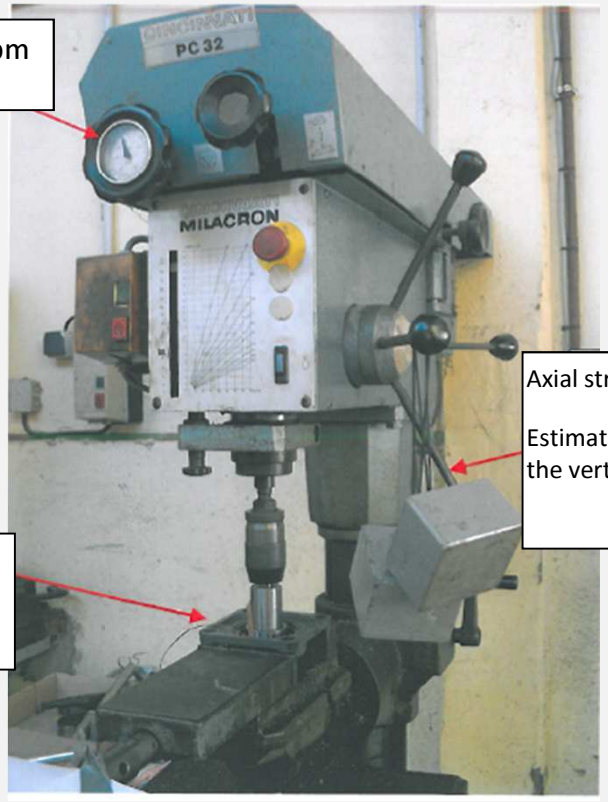
2. Accumulation of fines particles (aluminium, nitrate) in confined chamber.

3. Confinement increases the friction and reduces heat dissipation.

4. Heat source by friction were located inside the bearing (balls bearing) at the bottom of vertical auger.

REPRODUCIBILITY OF THE INCIDENT

❑ With the Labs of EPC-France, an experimental study has been made to reproduce the incident



Speed : 300 rpm

Axial strength : 55 daN

Estimated weight of the vertical auger

Bearing with temperature measurement

Use a drill equipment with :
Many samples of chemical composition (% Al – AN)
Type of bearing
Presence of grease

REPRODUCTIBILITY OF THE INCIDENT

Movie from the Labs of EPC-France

ROOT CAUSES

The root causes are:

- Lack of HAZOP
- Design
- Lack of housekeeping
- Lack of preventive maintenance rules

ACTIONS TO PREVENT RECURRENCE

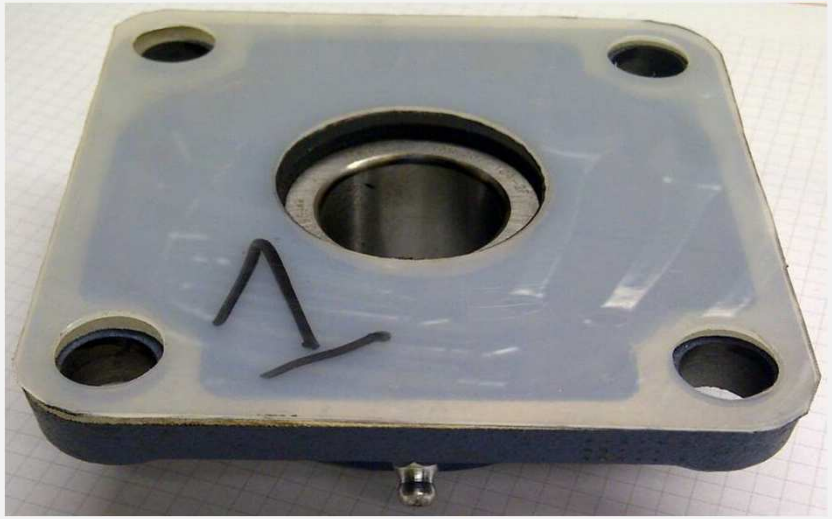
The incident allowed us to understand the effect of the lack of preventive maintenance on our fleet of MEMU Trucks and a problem in the design of the sealing arrangement of the auger.

Now, once a month, visual inspection of the gasket seal and the bearing is carried out. At 12 months, the gasket seal and the bearing are replaced.

With the contribution of our technical service EPC-Innovation, a new design of the auger was made. The modification on the truck was implemented in January 2013. The modification of the auger has also been implemented to improve the sealing arrangement.

From the results of the tests from the EPC-France Lab, we have changed the type of bearing by using a bearing with structured steel (which cannot burn in case of overheating).

ACTIONS TO PREVENT RECURRENCE



layer of Ertacetal on the bearing – (additional protection)

TAKE HOME MESSAGE

This incident reminds us that the MEMU truck is a mobile explosive plant. The operator/driver has to be vigilant on a regular basis regarding the corresponding danger. Being unprepared for such an incident, and our reactions to it, are areas we can improve.

Personally, being present near to the auger during the incident, I was unable to find the fire extinguisher which was only 1 m away from me.

Due to the stress, we lost 80% of our abilities. I estimate that 1 or 2 minutes were lost trying to locate a fire extinguisher.

I recommend to train the team (driver, MEMU operator, shotfirer, miners …) to know the locations of the emergency STOP and the position of the nearest extinguisher and how and when to use it.

SINCERE THANKS TO

Thierry ROUSSE, Safety Manager of EPC GROUP, for his help during all period of this incident

EPC-Innovation team : Thierry Henon, Jim Eaton, Stuart Swift, …

EPC-France Labs : Pascale Gallovich

QUESTIONS

EPC GROUPE

THANKS YOU
FOR YOUR ATTENTION

ANY QUESTIONS ?