BEA-TT
Bureau d'Enquêtes sur les Accidents de Transport Terrestre
(Land Transport Investigation Bureau)

Report on the derailment of dangerous goods wagons on 22 May 2010 at Neufchateau (88)

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Conseil Général de l'environnement
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B*ureau d'Enquêtes sur les Accidents*
de Transport Terrestre **(Land Transport Investigation Bureau)**

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Progress report on the derailment of dangerous goods wagons on 22 May 2010 at Neufchateau (88)

Document form

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Warning

The technical investigation forming the subject of this report was carried out under Title III of Law No 2002-3 dated 3 January 2002, and Decree No 2004-85 dated 26 January 2004, concerning inter alia technical investigations after a land transport accident or incident.

The sole purpose of this investigation is to prevent future accidents, by determining the circumstances and causes of the analysed event and by establishing useful safety recommendations. It is not intended to determine responsibilities.

Consequently, use of this report for purposes other than prevention may lead to erroneous interpretations.

CONTENTS

Glossary

- AFWP: *Association Française des Wagons de Particuliers* (French Association of Private Wagons)
- AFR: Arbel-Fauvet-Rail; wagon manufacturer
- Atirrail, Ermewa, EVS, GATX, VTG: wagon keepers
- DB: *Deutsche Bahn*; German railway company
- EPSF: *Etablissement Public de Sécurité Ferroviaire* (French Railway Safety Authority)
- NACCO: keeper of the wagon implicated in the derailment at Neufchateau
- RFN: *Réseau Ferré National* (National railway network)
- RAT: *Reconnaissance à l'Aptitude au Transport* (transport certification)
- SNCF: French railway company
- Valdunes: French manufacturer of wheels, axles and wheel-sets for the rail industry
- VT: Technical visit

Summary

On 22 May 2010, the last four wagons of the SNCF 58701 freight train derailed and keeled over in the middle of the track, just before Neufchateau station.

Three of these wagons were tanks of dangerous goods. One of them, containing phenol, had a leak at the dome. This led to a danger area being set up, followed by long and complex sealing and decanting operations.

The accident did not claim any victims, but the damage to the infrastructure and the consequences to traffic were considerable.

The derailment seems to be due to the front left wheel breaking on the first derailed wagon. Approximately one third of the rim is missing and the plate has circular cracks in an area located approximately 300 mm from the axle.

In the context of protective measures engaged by the *Etablissement Public de Sécurité Ferroviaire* (French Railway Safety Authority) and during the investigation by the BEA-TT (French NIB), similar damage was detected on a certain number of wheels equipping wagons in service.

In December 2010, considering the information collected at that stage, the BEA-TT considered it necessary to issue an initial series of safety recommendations aimed at preventing the repetition of similar accidents, without waiting for the conclusion of the investigation and in compliance with article L1621-20 of the *Code des Transports* (Transport Regulations).

In this context, 5 recommendations were formulated:

- One concerns extending the wheel verification campaign,
- Three concern maintenance and inspection of wagon axles,
- One concerns the railway facilities at the Roussillon industrial site.

1 - Immediate observations and undertaking of the investigation

On 22 May 2010, the last four wagons of freight train SNCF 58701 derailed and keeled over in the middle of the track, just before Neufchateau station.

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The accident did not claim any victims, but the damage to the infrastructure and the consequences to traffic were considerable.

This information led to the director of the BEA-TT deciding to undertake a technical investigation.

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The purpose of this progress report is to present these recommendations along with the analysis that justifies them.

2 - Observations on the derailed rolling stock

The front left wheel of the first derailed wagon is broken. Approximately one third of the rim is missing and the plate has circular cracks in an area located approximately 300 mm from the axle.

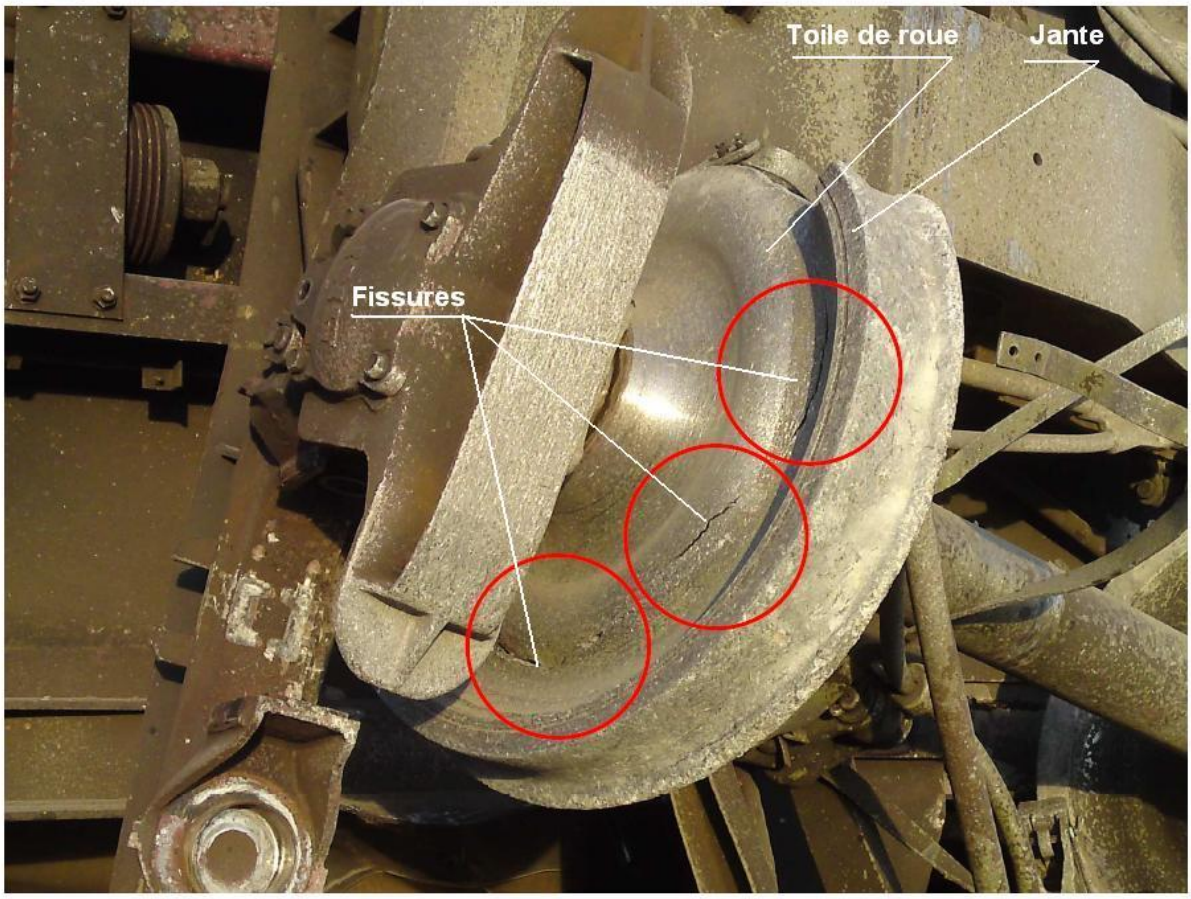

Figure 1 View of the damaged axle, on the wagon that derailed and keeled over

Toile de roue	Wheel plate
Jante	Wheel rim
Fissures	Cracks

This wagon bears the number 33 87 779 2 9543-9 and belongs to NACCO.

It is a 70 m^3 tank wagon intended for the transport of phenol.

It was part of an order for 150 different types of tank wagons built in 1995 by Arbel-Fauvet-Rail (AFR) for Rhône-Poulenc Industrie.

These wagons have 9054-type axles; they were manufactured in 1995 by Valdunes.
The axle comprising the broken wheel bears the No 543205. This wheel bears the casting number B8924; the other wheel on the axle, which is not cracked, bears the casting number B8581.

3 - Protective measures on the rolling stock

Considering the seriousness of the damage observed on the above wheel and the possibility that precursory defects are present on other equipment, on 27/05/2010, the EPSF gave the following instructions to all wagon keepers listed in France:

- *Stop wagons and inspect the axles of Valdunes castings B8924 and B8581,*
- *Report the inspections to the EPSF.*

(The 188 axles that make up the two castings indicated above were attributed to Rhône Poulenc, as well as other wagon keepers).

On 4/06/2010, the DB detected circular cracks in plates at Mannheim, on two wheels on an axle of a NACCO wagon for transporting phenol, of the same type as that of Neufchateau and from the same batch, manufactured by AFR in 1995.

This led the EPSF to reinforce the protective measures on this batch of 150 wagons that is now distributed between wagon keepers Atirrail, Ermewa, VTG and NACCO. To do this, on the 6/06/2010, it gave the following instructions to wagon keepers Atirrail, Ermewa, VTG, Nacco and the railway companies:

- *Pay specific attention to the visual examination of the wheels during the Reconnaissance à l'Aptitude au Transport (Transport certification) operations [1] (RAT),*
- *Specific examination of the 150 wagons manufactured by AFR in 1995 for Rhône Poulenc.*

On 7/06/2010, in the context of these measures, NACCO personnel detected a wheel crack on a wagon in Le Havre and another on a wagon at Thionville. These two wagons for transporting phenol and belonging to Nacco are part of the batch of 150 wagons mentioned above.

On 9/06/2010, Valdunes gave a list of 813 9054-type axles for which the production period covers those of the cracked axles detected to date.

On 10/06/2010, the EPSF gave the following instruction to wagon keepers Atirrail, Ermewa, VTG, Nacco and the railway companies:

- *Stop the 150 wagons on the spot,*
- *Visual examination of their axles before transportation to a lifting workshop,*
- *Magnetic particle examination of the plates.*

On 18/06/2010, the EPSF extended the measures dated 10/06 to wagons with an axle that could previously have been fitted under one of the 150 AFR wagons.

[1] This operation is carried out after each train is formed, before departure.

Finally, the visual and magnetic particle examination campaign covered 9054-type Valdunes axles bearing the numbers 541925 to 542124, 543017 to 543426 and 53853 to 553867, i.e. 625 axles.

4 - Factual information collected to date

4.1 - Cracks detected under the preventive measures

To date, the axles concerned by the measures dated 10 and 18/6, and located under the wagons or in the storage areas of the four wagon keepers, Nacco, Attirail, Ermewa and VTG were visually examined and removed.

The other wagon keepers did not report any cracked axles.

The magnetic particle examinations on Ermewa axles are finished. The examinations for the Atirrail, VTG and Nacco axles are still in progress.

The provisional results are given below:

Wagon keeper	Wagon type	Wagons	Axles removed	Magnetic particle examination	Cracks confirmed	Cracks (spectrums) to be confirmed
Nacco	70 m^3 Phenol	30	192	167	18 w/16axl	0
	104 m^3 Ammoniac	20			0	0
	Additional axles					
VTG	50 m^3 Sodium	50	179	119	6w/6axl	4
	Additional axles		20	14		
Ermewa	104 m^3 Ammoniac	10	40	40	0	0
	Additional axles		1	1		
AtirRail	70 m^3 Phenol [2]	20	64	64	0	0
	104 m^3 Ammoniac	20	72	72	0	0
	Additional axles		7	7	7	
Others	Miscellaneous		NC	NC	0	0
Total		150			**24w/22axl** including 16w/15axl confirmed by the SNCF to date	4

4.2 - Other similar cracks detected since June 2010

The warnings released by the EPSF, and relayed by the railway companies and wagon keepers, have allowed the following cases to be detected on Valdunes axles, outside the scope of the 150 ex-Rhône-Poulenc wagons and the 625 associated axles:

- *1 9054-type axle belonging to Nacco produced in June 1989 with a wheel showing two cracks of 20 and 40 mm located 280mm from the axle. Detected on 20/08/2010 at Lormafer.*

[2] Wagons now used to transport acetic acid

- *5 9054-type axles belonging to Gatx produced in 1990 with wheels showing various cracks. (detected on 28/10 in Austria)*

4.3 - Other similar cracks reported by feedback from wagon keepers

- 3 axles, 9071 B type, with 7 cracked wheels ([3]) manufactured in 1999 and detected in Germany underneath a NACCO soda lye wagon, on 8/02/2007. At that time, the axles concerned were sent by the wagon keeper, to the manufacturer Valdunes, for examination, but the case was not reported to SNCF, which performed the maintenance engineering.

- 1 (one) 9052-type axle with both wheels cracked (wheels produced in 1976) detected in Romania underneath an EVS wagon in September 2009 and assessed in the SNCF workshop in Tergnier on 26/08/2010.

4.4 - Wheel maintenance

Independently of the Technical Visits (VT) and the *Reconnaissance à l'Aptitude au Transport* (RAT) (transport certification) operations carried out in the normal wagon operating context, the detection of cracks on plates is covered, in the context of the SNCF maintenance programme for wagons by:

- A visual examination underneath the vehicle during periodic servicing and accident repairs to the wagon (visible part of the wheel only, without rotation);

- A visual examination during axle servicing (periodicity of 19 years or 600,000 km), with the axle removed and cleaned.

4.5 - Observations on the railway sidings at Roussillon

The chemical platform at Roussillon is at the origin of the phenol traffic provided by the Nacco wagons on which damage was observed. It also receives traffic of soda lye.

During the BEA-TT's visit to the rail facilities on this site, an area with a narrow gauge was detected on the track leading to the phenol loading station, notably at the level of a tarmac road crossing.

A gauge of 1416 mm[4] was measured, whereas the minimum stipulated on the service tracks bearing traffic of dangerous goods is 1420 mm.

On a track leading to a soda lye unloading station, a wide gauge of 1475 mm was measured, whereas the maximum is 1472 mm.

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[3] These wheels are "Low stress" VMS wheels and therefore, of a different type to that of the other wheels mentioned in this progress report.

[4] During a second visit by the BEA-TT, this measurement was not confirmed; as the measured gauge was then 1422 mm. It must be noted that the measurement is marred by considerable uncertainty due to the presence of a significant wear ridge on the inside of the rail head.

5 - Provisional BEA-TT analysis

5.1 - Concerning the verification campaign

- The number of cracks detected is abnormally high. Given that, on the national rail network, the only similar cases recorded in 20 years on Valdunes wheels are a wheel breakage on an RATP railcar in 2001 at Le Bourget and a crack detected during maintenance on a wagon wheel in 2003 at Tergnier, the rate of occurrence presently observed is abnormal, even if we take the heightened level of attention adopted by the maintenance staff into consideration.

- The concentration of cases detected, during the verification campaign, on Nacco phenol wagons and VTG soda lye wagons, is probably no coincidence.

- The multiple damage cases observed on the same kind of wagon (Romania 2009, Germany 2007, Germany 2010 and Austria 2010) are also probably no coincidence.

- The concentrations of cases and the multiple damage may be notably due to specific stresses (loads, routes, braking and mechanical forces) and/or repetitive geometrical or metallurgical particularities within the same wheel production batch.

Considering the uncertainty that remains on the origin, or the origins, of the disorders observed, the verification of wheels coming from the same production batches as the wheels detected with cracks, is the principal measure of targeted prevention that can currently be employed.

The set of 625 axles, concerned by the verification campaign arranged in June 2010, does not cover the entire field concerned, in particular considering the cases detected outside that campaign.

This led the BEA-TT to issue the following recommendation:

Recommendation R1 (EPSF)

Extend the verification campaign arranged on 10 and 18 June 2010 by taking into consideration the detections made or highlighted again since that date.

5.2 - Concerning maintenance of wagon wheels

- The visual examination underneath the vehicle, during periodic servicing and accident repairs, forms an essential link in detecting cracks on plates. Its reliability is based on operators' conscientiousness and motivation. It is

certainly difficult to believe that these operators can be perpetually convinced of the importance of an operation where it is only possible to see less than one third of the outside face of the plate, due to obstruction by the axle box and the bogie suspension.

- The visual examination during axle servicing is carried out after the axle has been washed and then brushed or shot blasted. The traces of rust that signal the presence of a crack are eliminated by cleaning, making visual detection more difficult.

Independently of the targeted verification campaigns mentioned above, it is important for the wagon maintenance system to allow incipient cracks to be effectively detected, on all types of wagons and axles, before they become dangerous. This led the BEA-TT to issue the following recommendations concerning the detection framework ([5]) for cracks in plates on wagon wheels:

Recommendation R2 (AFWP)

Convey to wagon keepers the recommendation that they should reinforce and improve the reliability of the detection frameworks for cracks in the wheels on their wagons, in liaison with their entities in charge of maintenance or their maintenance engineering service providers.

Recommendation R3 (SNCF, as maintenance engineering service provider)

Reinforce and improve the reliability of the detection framework for cracks in the plates of wagon wheels, underneath the vehicles and with the axles removed.

Examine in particular the entire plate underneath the vehicle, consider rotating the axles during certain maintenance operations and consider the traceability of this operation.

5.3 - Concerning inspection operations during operation

Even though detection of cracks on plates is not always possible during inspection operations when operating (RAT, VT, etc.), as a large section of the wheels is barely visible, these operations form a remedial method that is worth considering.

As this type of damage was virtually inexistent on the RFN up until last June and in any case, remains a rare event, the involvement of rail companies is necessary and will remain so to ensure that the staff concerned stay vigilant and motivated.

Recommendation R4 (EPSF)

Ask the rail companies operating on the RFN to ensure that the staff charged with inspecting the wagons in operation (RAT, VT, etc.) remain perpetually vigilant, concerning the search for cracks on plates and if necessary, to explicitly include this search in the manuals of the trades concerned.

[5] Detection framework refers to the consistency and occurrence of the operations used to detect the defects that are looked for.

5.4 - Concerning private sidings

Defects on the track, observed on the rail facilities at the Roussillon site may subject the running gear of wagons to additional forces, and they represent a risk of derailment. These anomalies must be rectified, hence the following recommendation:

Recommendation R5 (OSIRIS[6])

Bring the rail facilities on the Roussillon industrial site into line with current track standards.

[6] OSIRIS is the company that manages the infrastructures at the Roussillon site.

6 - Conclusions and recommendations

The cause of the derailment of the first wagon involved in the accident appears to be related to the front left wheel breaking, resulting from a crack forming on the wheel plate during operation.

The causes of this cracking and the sudden increase in cracks on the plates of wagon wheels remain unexplained for the moment.

Considering this uncertainty and the cases detected since June 2010, the scope of the verification campaign, undertaken by the EPSF, must be extended.

Furthermore, the reliability of detecting cracks on the plates of wagon wheels during maintenance operations must be improved and the staff charged with inspections during operation must remain perpetually vigilant.

Lastly, the anomalies observed on the rail facilities at the Roussillon site must be rectified.

Without waiting for the conclusion of the investigation, the BEA-TT formulates the following recommendations:

Recommendation R1 (EPSF)

Extend the verification campaign arranged in June 2010 by taking into consideration the detections made or highlighted again since this date.

Recommendation R2 (AFWP)

Convey to wagon keepers the recommendation that they should reinforce and improve the reliability of the detection frameworks for cracks in the wheels on their wagons, in liaison with their entities in charge of maintenance or their maintenance engineering service providers.

Recommendation R3 (SNCF, as maintenance engineering service provider)

Reinforce and improve the reliability of the detection framework for cracks in the plates of wagon wheels, underneath the vehicles and with the axles removed.

Examine in particular the entire plate underneath the vehicle, consider rotating the axles during certain maintenance operations and consider the traceability of this operation.

Recommendation R4 (EPSF)

Ask the rail companies operating on the RFN to ensure that the staff charged with inspecting the wagons in operation (RAT, VT, etc.) remain perpetually vigilant, concerning the search for cracks on plates and if necessary, to explicitly include this search in the manuals of the trades concerned.

Recommendation R5 (OSIRIS)

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