



## INVESTIGATING REPORT

on the fire occurred at the locomotive DHC 80-0172-9  
belonging to SNTFC “CFR Calatori” SA,  
in the running of the train no. 17360 on the 8<sup>th</sup> of September 2010,  
on the non-interoperable running section Oravita – Berzovia (km. 45+700)



## NOTICE

With reference to the accident occurred on the 8<sup>th</sup> of September 2010, on the non-interoperable running section Oravita – Berzovia (managed by SC RC-CF TRANS SRL Brasov), between the railway station CFR Oravita and the flag station Gradinari – Caras, at km. 45+700, in the running of the train no. 17360 (belonging to SNTFC “CFR Calatori” SA Bucharest) composed of the locomotive DHC 80-0172-9 in head and the locomotive DF 69-004-7 at wheel (towed in cold condition), consisting of a fire at the locomotive DHC 80-0172-9, Romanian Railway Investigating Body carried out an investigation according to the provisions of the Government Decision no. 117/2010. Through the investigation, the information on the respective accident was gathered and analyzed, the conditions were established and the causes determined.

Romanian Railway Investigating Body investigation did not aim to establish the guilty or the responsibility in this situation.

Romanian Railway Investigating Body considers necessary to take corrective measures in order to improve the railway safety and to prevent the accidents, so it included in the report a series of safety recommendations.

Bucharest, February 2011

*Approved by*  
Dragoş FLOROIU  
**Director**

*I agree the compliance with the legal provisions  
on the investigation performance and  
drawing up of this Investigation Report,  
that I submit for approval*

**Chief Investigator**  
Sorin CONSTANTINESCU

*This approval is part of the Report for the investigation of the accident occurred on the 8<sup>th</sup> of September 2010, on the range of activity of CF Timisoara Regional Branch, on the non-interoperable running section Oravita – Berzovia belonging to SC RC-CF TRANS SRL Brasov – Section Timisoara, between the railway station CFR Oravita and the flag station Gradinari – Caras (simple line non-electrified), at Km. 45+700, in the running of the train no. 17360 belonging to SNTFC “CFR Calatori” SA Bucharest, consisting of a fire at the locomotive DHC 80-0172-9.*

## CONTENT

<b>I. Preamble</b>	4
I.1. Introduction	4
I.2. Investigation process	4
<b>A. Brief presentation of the accident</b>	5
A.1. Brief presentation	5
<b>A.2. Causes of the accident</b>	5
A.2.1. Direct cause	5
Contributing factors	5
A.2.2. Underlying causes	5
A.2.3. Root causes	5
<b>A.3. Severity level</b>	6
<b>A.4. Safety recommendations</b>	6
<b>B. Investigating report</b>	6
<b>B.1. Description of the accident</b>	6
<b>B.2. The accident circumstances</b>	8
B.2.1. Involved parties	8
B.2.2. Forming and equipments of the train	8
B.2.3. Railway equipments	8
B.2.4. Means of communications	8
<b>B.3. The consequences of the accident</b>	8
B.3.1. Deaths and injuries	8
B.3.2. Material damages	8
B.3.3. Consequences of the accident in the railway traffic	9
<b>B.4. External circumstances</b>	9
<b>B.5. Investigation course</b>	9
B.5.1. The summary of the of the involved staff statements	9
B.5.1.1. The summary of the of the railway undertaking and infrastructure manager staff statements	9
B.5.2. Safety management system	11
B.5.3. Norms and regulations. Sources and references for the investigation	11
B.5.4. Work of the rolling stock	11
B.5.4.1. Data found on the locomotive DHC 80-0172-9	11
B.5.4.1.1. Data resulting during the checks made on the 16 <sup>th</sup> of September 2010 by the investigation commission and the repair staff from the locomotive Depot	12
B.5.4.1.2. Data resulting from the analysis of the documents asked to the railway infrastructure manager	17
<b>B.6. Analysis and conclusions</b>	17
B.6.1. Analysis of the incident occurrence	17
<b>B.7. The accident causes</b>	17
B.7.1. Direct cause	17
B.7.2. Underlying cause	17
B.7.3. Root cause	17
<b>C. Safety recommendations</b>	17

## **I. PREAMBLE**

### **I.1. Introduction**

The fire occurred at the locomotive DHC 80-0172-9 hauling the train no. 17360 on the 8<sup>th</sup> of September 2010, is an accident that is found at the art. 7, paragraph (1), letter e) from the ***Regulations for the investigation of the accidents and incidents, for the development and improvement of Romanian railway and subway safety***, approved by Government Decision no. 117/2010, hereinafter referred as “***Regulations***” in the investigation report.

Given the above and under the art. 19, paragraph (2) from the *Law no. 55/2006 on the railway safety*, corroborated with the art. 48, paragraph (1) of the ***Regulations***, an investigation commission was appointed by Romanian Railway Investigating Body.

Through the investigation, the information on the respective accident was gathered and analyzed, the conditions were established and the causes determined.

Romanian Railway Investigating Body investigation did not aim to establish the guilty or the responsibility in this situation.

### **I.2. Investigation process**

On the 8<sup>th</sup> of September 2010 Romanian Railway Investigating Body was informed by the Regional Inspectorate of traffic safety from CF Timisoara Regional Branch through the investigator responsible of the territorial structure, about the occurrence of a railway accident between the railway station Oravita and the flag station Gradinari-Caras, at Km. 45 + 700, in the running of the train no. 17360, consisting of a fire at the locomotive DHC 80-0172-9, and after going to the place of the accident were found the following:

- train no. 17360 composed of the locomotive DHC 80-0172-9 active and the locomotive DF 69-004-7 at wheel (towed in cold condition), was stopped in current line at km. 45+700 between the railway station Oravita and the station Gradinari-Caras;
- the driving cab and the cabin electrical installation were damaged by the fire;
- the high hood was affected by combustion in the area next to the air filters;
- the bottom side between the bogies, above the main diesel tank and on the left of the main diesel tank (in the running direction) were affected by the fire;
- the line and the installations were not affected in the area of the accident.

There were no deaths or injuries.

At the accident place were present the representatives of:

- Inspectorate for Emergency Situations "Semenic" from Caras-Severin County – Firemen Point Oravita;
- Operative Department of Railway Transports Police;
- Romanian Railway Safety Authority;
- RC – CF Trans SRL Brasov – Timisoara working point;
- National Society of Railway Passengers Transport “CFR Calatori” SA – RTFC Timisoara.

Through the Decision no. 32 from the 9<sup>th</sup> of September 2010 of the Director of the Romanian Railway Investigating Body, according to the provisions of the art. 19, paragraph (2) of the *Law no. 55/2006 on the railway safety*, corroborated with the art. 48(1) of the ***Regulations***, the investigation commission was appointed, consisting in:

• Bobe Cristian – head of IAFG – OIFR	- main investigator
• Oltenacu Livius – investigator – OIFR	- member
• Fleancu Constantin – head of SCPMAII – RTFC Timisoara	- member

## **A. BRIEF PRESENTATION OF THE ACCIDENT**

### **A.1. Brief presentation**

On the 8<sup>th</sup> of September 2010, the train no. 17360 running between Oravita-Timisoara Nord, composed of the active locomotive DHC 80-0172-9 and the locomotive DF 69-004-7 at wheel (towed in cold condition), after passing by the flag station Greoni, running on the current line to the flag station Gradinari – Caras, at km. 45+700, a fire occurred at the bottom side of the locomotive DHC 80-0172-9 and extended to the driving cab.

Unable to localize and extinguish the fire together with the staff of the locomotive DHC 80-0172-9, the assistant from the locomotive DF 69-004-7 called from his mobile phone the unique emergency number 112, asking for the intervention of the Inspectorate for emergency situations. The fire was localized and extinguished at 9:45a.m. by the military firemen belonging to the Inspectorate for emergency situations “Semenic” of Caras-Severin County – Oravita Firemen Point. The firemen intervention required closing the current line between the railway station CFR Oravita and the flag station Gradinari – Caras.

The locomotive DHC 80-0172-9 belongs to SNTFC “CFR Calatori” SA and was driven / served by the locomotive – automotor driver / driver assistant and the locomotive DF 69-004-7 belongs to SNTFC “CFR Calatori” SA and was served / assisted by the locomotive driver.

The place of the accident is located on the running section Oravita – Berzovia (non-operable running section managed by RC – CF TRANS SRL Brasov), on the current line between the railway station CFR Oravita and the flag station Gradinari – Caras, in the area of the km. 45+700, placed in transverse mixed profile, the line being in alignment and gradient ramp to 3‰ in the running direction.

### **A.2. Causes of the accident**

#### **A.2.1. Direct cause**

The fire occurred by the ignition of existing oil deposits in the area located above the wheel on the right of the axle no. 2 in the running direction of the locomotive (on the air and oil pipes, on the inner sides of the stringers, main outer and longitudinal inner, and on the bottom side of the chassis), by the incandescent material particles (sparks) detached from the shoe located on the back side of the right wheel from the axle no. 2 as a result of the service braking during the running of the locomotive.

#### **Contributing factors**

- the existence of the oil products in the areas of construction sealing of the installations located at the bottom side of the locomotive and their deposit in hardly accessible areas;
- the existence of wears in the transmission parts joints, of the braking effort through the locomotive braking wheelhouse, which led to the shoe application outside of the wheel tread and also the uneven transmission of the braking efforts to the two shoes corresponding to the right wheel from the axle no. 2.

These factors were determined by the wear condition of the locomotive installations and units, as a result of missing the deadline of the specific works for the repair type to which the locomotive was due (due to RG type repair since May 2008).

#### **A.2.2. Underlying cause**

None.

#### **A.2.3. Root causes**

None.

### A.3. Severity level of the accidents

According to the provisions of the **Regulations**, the event is categorized as accident, under the art. 7, paragraph (1), letter e.

### A.4 Safety recommendations

The safety recommendations aim to solve the next issues:

- 1 Compliance with the deadlines to put in planned repairs the locomotives;
- 2 Regular cleaning of the fuel residues accumulations from the areas inclined to accidental ignition of the locomotive, tasks to be included in the technological processes of the periodic inspections;
- 3 Checking the brake wheelhouse at the hydraulic diesel locomotives to detect wears in joints and take control measures at technical planned revisions.

The addressees of the safety recommendations are: National Society of Railway Passengers Transport “CFR Calatori” SA and “CFR – SCRL Brasov” SA.

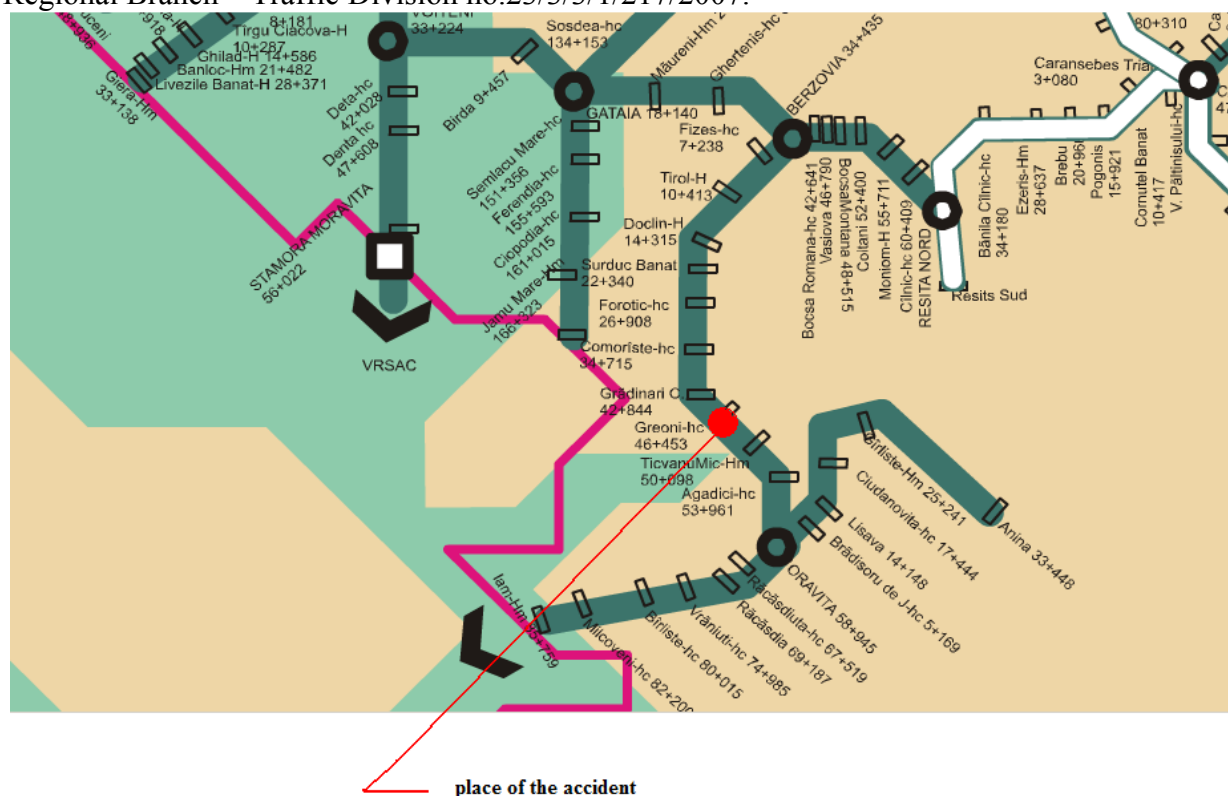
This investigation report will be sent to Romanian Railway Safety Authority, to National Society of Railway Passengers Transport “CFR Calatori” SA and to “CFR – SCRL Brasov” SA.

## B. INVESTIGATING REPORT

### B.1. Description of the accident

On the 8<sup>th</sup> of September 2010, the train no. 17360 was running between Oravita-Timisoara Nord being composed of the active locomotive DHC 80-0172-9 and the locomotive DF 69-004-7 at wheel (towed in cold condition).

The non-interoperable current line between Oravita-Berzovia is not electrified and the trains run under the centralized driving system with specifications listed in the Regulations of operations of the running section Berzovia-Oravita established by the infrastructure manager of CF Timisoara Regional Branch – Traffic Division no.23/3/3/1/217/2007.



Geographical position of the accident



The train no. 17360 left at 8:44a.m. from the railway station CFR Oravita, and at 9:00a.m., after passing by the flag station Greoni, in the area of the km.45+700, the locomotive staff serving the locomotive DHC 80-0172-9 smelled smoke, so that the locomotive driver took actions to stop and brake the train and the driver assistant opened the doors of access from the dynastarter, moment when the fire occurred at the bottom side of the locomotive spread inside the driving cab.

The locomotive driver and the driver assistant took actions to localize the fire with the extinguishing means in the locomotive equipment, contributing to this also the locomotive driver assisting the locomotive DF 69-004-7. Given the fast spreading of the fire and the locomotive staff inability to localize the fire, the driver assisting the locomotive DF 69-004-7 called the Unique National System for Emergency Calls at 112.

Starting with 9:30 a.m. the military firemen belonging to Oravita Firemen Point began the extinguishing procedures, the fire being localized and extinguished at 9:45 a.m.

No deaths or injuries.



Effects of the fire on the equipment of control, indication and protection from the driving cab

From the thermal effect of the fire in the area on the main tank on the left in the running direction, there was an overpressure in the tank followed by the upper surface deformation and breaking its two tank mounting bolts on the main strut and the crack in the tank sides joining areas (two cracks in the upper side of the tank and one at its bottom), which led to entire quantity of oil leaking from the tank, to axle no. 3, on the left side of the locomotive.

To fit to the dimensional quotas set for the locomotive CFR gauge, it was necessary to insure the main tank through the intervention of a team belonging to Timisoara Locomotives Repairs Department from Locomotives Repairs Company “CFR SCRL” Brasov.

At 3:40 p.m. the train consisting of the locomotives DHC 80-0172-9 and DF 69-004-7 was withdrawn in Oravita railway station and at 3:48 p.m. the current line between the railway station CFR Oravita and the flag station Gradinari – Caras was opened for railway traffic.



## **B.2. The accident circumstances**

### **B.2.1. Involved parties**

The involved staff belongs to Timisoara Locomotive Depot from SNTFC “CFR Calatori”- SA – Timisoara Regional Passenger Transport.

The locomotive DHC 80-0172-9 belongs to SNTFC “CFR Calatori”- SA and is maintained by the staff belonging to Timisoara Locomotives Repairs Department from SCRL “CFR – SCRL Brasov” SA.

The non-interoperable railway infrastructure, on which the accident occurred, is managed by RC – CF Trans SRL Brasov –Timisoara Working Point and is maintained by the staff from Banat Surduc District.

The investigation commission questioned the employees involved in driving / serving the involved locomotives and the locomotives repair / maintenance staff.

### **B.2.2. Forming and equipments of the train**

Driving of the train no. 17360 consisting of the towing locomotive DHC 80-0172-9 and the locomotive DF 69-004-7 (towed in cold condition) was insured by a complete team composed of locomotive driver and driver assistant and the assistance of the locomotive DF 69-004-7 (towed in cold condition) was insured by a locomotive driver and also by a guard appointed for closing/opening the mechanical barriers on the non-interoperable running section Oravita – Berzovia, according to the specifications listed in the Regulations of operations of the running section Berzovia-Oravita established by the infrastructure manager of CF Timisoara Regional Branch an registered by the Traffic Division from the branch under the no.23/3/3/1/217/2007.

After the fire there was found that the safety and vigilance device (DSV), the equipment for the point control of the speed and hitchhiking (INDUSI), the installation of speed indicating and recording of the locomotive DHC 80-0172-9 were damaged and all the accompanying documents existing in the driving cab (except the roadmap) and IVMS plant records were destroyed by burning.

### **B.2.3. Railway equipments**

The place of the accident in the area of the km. 45+700, on the current line Oravita - Berzovia (simple line non-electrified) placed in mixed transverse profile, in line (built with rail type 49, on wooden sleepers, with joints) and slope gradient of 3‰ in the running direction.

### **B.2.4. Means of communication**

The communication between the locomotive driver and the movement inspectors was insured through the radiotelephone installation.

## **B.3. Accident consequences**

### **B.3.1. Deaths and injuries**

None.

### **B.3.2. Material damages**

- at the locomotive DHC 80-0172-9, according to the estimate no. 6097/2010 of Timisoara Locomotives Depot from SNTFC “CFR Calatori” SA – Passengers Transport Timisoara Branch, amounted to **31093.41 lei**;



- at the lines according to the document 30/2/L/20.09.2010 of RC-CF TRANS SRL Brasov – none;
- at the installations according to the document 30/2/L/20.09.2010 of RC-CF TRANS SRL Brasov – none;
- at the environment – none;
- **Total – 31093.41 lei**

### **B.3.3. Consequences of the accident in the railway traffic**

On the 8<sup>th</sup> of September 2010 the current line between the railway station CFR Oravita and the flag station Gradinari – Caras was closed for railway traffic between 9:00 a.m. - 3:48 p.m.

Following the occurrence of this accident a train was canceled and 3 trains were delayed by a total of 124 minutes, as follows:

- the passenger train no. 14480 – canceled;
- the passenger train no. 14481 delayed by 69 minutes and canceled on the distance Gradinari-Caras and Oravita;
- the passenger train no. 14482 delayed by 32 minutes and canceled on the distance Gradinari-Caras and Berzovia;
- the passenger train no. 14483 delayed by 23 minutes, being composed of the passenger train no. 14482.

### **B.4. External circumstances**

On the 8<sup>th</sup> of September 2010, according to the data recorded to the meteorological station Oravita (the nearest to the place of the accident), the visibility was good, clear sky, no wind and air temperature was about 20<sup>0</sup> C.

The visibility of the light signals was in accordance with the specific regulations in force.

### **B.5. Investigation course**

#### **B.5.1. The summary of the of the involved staff statements**

##### **B.5.1.1. The summary of the railway undertaking staff statements.**

**The locomotive driver** who drove the locomotive DHC 80-0172-9, on the 8<sup>th</sup> of September 2010, stated as follows:

- normal driving conditions between Oravita – Greoni with approximate speed of 50 km/h, for the speed maintenance using the automatic braking;
- after passing by the flag station Greoni he noticed a smoke release on the right bottom side of the locomotive between the bogies, so he took immediate actions to stop the train;
- the driver assistant opened the access door of the dynastarter, moment when in the locomotive cab entered a dense black smoke;
- he went down from the locomotive and saw a flame in the area of the main diesel tank and the axle attack no. 3;
- together with the driver assistant he used the fire extinguishers from the equipment and those brought from the locomotive DF 69-004-7, trying to extinguish the fire;
- unable to extinguish the fire, he asked the driver assisting the DF 69-004-7 to ask for the intervention of the military firemen at 112 phone number and he informed by phone the RCF Timisoara dispatch about the situation;

**The driver assistant** who served the locomotive DHC 80-0172-9, on the 8<sup>th</sup> of September 2010, stated as follows:

- at the inspection when taking over the locomotive in Oravita railway station, no damage was found, which was communicated also to the locomotive driver;

- after leaving the railway level crossings placed after the flag station Ticvanu Mic he made an inspection by opening the door of dynastarter and he did not find anything special;
- after passing by the flag station Greoni, the driver noticed smoke at the bottom side of the locomotive and he took stopping actions and after stopping he insured the locomotive with the handbrake;
- he opened the access door of the dynastarter, from where a dense black smoke came out, reason for which he used the extinguishers in the equipment and those from the locomotive DF 69-004-7 trying to extinguish the fire;
- he didn't smell smoke before noticing the flame outside the locomotive, the flame being seen in the area of the dynastarter and on the left above the main diesel tank.

**The driver assisting the locomotive DF 69-004-7**, stated as follows:

- he took over the locomotive in SELC Oravita, to provide its serving while it was towed (in cold condition) to CF Timisoara Depot;
- the train 17360 ran in normal conditions until the km.45+700, when a smoke release occurred at the bottom right side of the locomotive DHC 80-0172-9;
- to maintain the train speed was used the automatic brake, this being observed by the increasing of the air pressure in the brake cylinders of the locomotive DF 69-004-7;
- after stopping the train he went with the extinguishers in the equipment of the locomotive DF 69-004-7 to help to the fire extinguishment;
- he asked through the mobile phone for the intervention of the firemen, calling 112.

**The locomotive driver** who handed over the service at the locomotive DHC 80-0172-9 on the 8<sup>th</sup> of September 2010, stated as follows:

- in the hauling of the train 9688 from the 8<sup>th</sup> of September 2010 it was difficult to achieve the switch by the power converter to the drive converter at the hydraulic transmission, manipulating in this regard the switch fault-running, about which he verbally informed the exchange driver in Oravita railway station;
- he did not find damages in the running, wiring, loss of oil or diesel.

**The driver assistant** who handed over the service at the locomotive DHC 80-0172-9 on the 8<sup>th</sup> of September 2010, stated as follows:

- in the hauling of the train 9688 from the 8<sup>th</sup> of September 2010 it was difficult to achieve the switch by the power converter to the drive converter at the hydraulic transmission because of the uphill profile of the towing section, the driver manipulating in this regard the switch fault-running;
- he did not find any other deficiencies in the operation of the locomotive DHC 80-0172-9.

**The guard** stated as follows:

- the normal place of work was in the driving cab of the locomotive DF 69-004-7, on the left in the running direction;
- he closed/opened the mechanical barrier at the level crossing located after h.Ticvanu and after about 4 km. he noticed a smoke release under the driving cab of the locomotive in front, reason for which he immediately gave stopping signals and he helped to the fire extinguishment with the traction staff.

**The shift leader with attributions of locomotive inspector** in SELC Oravita stated as follows:

- at the inspection of the locomotive DHC 80-0172-9 on the 7<sup>th</sup> of September 2010 he did not find damages;
- no defect was listed in the logbook and no work order was issued;
- he was not aware of the damages to the hydraulic transmission;

#### **B.5.1.2. The summary of the locomotive repairs/maintenance staff.**

**The locksmith coordinator of repairs work SELC Oravita** stated as follows:

- at the revision type PTh3 from the 6<sup>th</sup> of September 2010, the locomotive DHC 80-0172-9 didn't have obvious damages and no locomotive staff has requested additional work order;
- while providing service on the range of activity of SELC Oravita during July – September 2010, the locomotive DHC 80-0172-9 had problems the transistorized box of the hydraulic transmission which was replaced in the workshop from SELC Oravita;
- he did not find improvisations to the wiring of the locomotive DHC 80-0172-9;
- to the mechanical part were adjusted the brake cylinders, the wheelhouse of the handbrake;
- the locomotive DHC 80-0172-9 has the term of input to overhaul outdated;

**The locksmith repairs SELC Oravita** stated as follows:

- there were no deficiencies in the operation of the brake wheelhouse at the locomotive DHC 80-0172-9;
- some brake shoes eccentrically tread on the bandages due to the wears to the bolts and bushings of the brake wheelhouse;
- he did not replace the shoes at DHC 80-0172-9 during August – September 2010;
- there were no problems with the brake cylinders of the locomotive DHC 80-0172-9;

**The electrician repairs SELC Oravita** stated as follows:

- during August – September 2010 at the locomotive DHC 80-0172-9 made the electric repairs required by the locomotive staff through the repairs orders and the works specified at the revision type PTh3;
- he did not find electric damages in the electrical control circuit of the hydraulic transmission.

## **5.2. Safety management system**

In carrying out his responsibilities and duties, the infrastructure manager RC-CF Trans SRL Brasov and the railway undertaking SNTFC “CFR Calatori” SA created and implemented their own safety management system, ensuring the control of the performed activity risks.

### **B.5.3. Norms and regulations. Sources and references for the investigation**

In the investigation of the railway accident one took into account:

- minutes concluded by the commission on spot with reference to the condition of the rolling stock, lines and equipments;
- photos taken immediately after the railway accident by the members of the investigation commission;
- statements of the locomotive teams and train assistance, of locomotives repairs and maintenance;
- minutes concluded by the members of the investigation commission after the occurrence of the accident;
- documents on the locomotive maintenance and repair, provided by the persons in charge with its maintenance;
- inspection and interpretation of the technical condition of the elements involved in the accident;
- questioning of the staff in charge with the operation of the involved rolling stock, of the locomotives repairs/maintenance;
- documents of release of the train;
- documents on the repair/maintenance of the locomotive;

### **B.5.4. Work of the rolling stock**

#### **B.5.4.1. Data found on the locomotive DHC 172:**

As a result of checks carried out by the investigation commission at the locomotive, one found out:

- condition of the locomotive driving cab:

- burned floors, walls and ceiling trim;
- at the electrical control and protection equipment was found the full burning of the wiring insulation and of the terminal block;
- equipments and safety and vigilance installations subsets, INDUSI, speedometers, existing in the driving cab, damaged due to thermal effect;
- at the entire electrical equipment in the driving cab were not found specific signs of the electrical short-circuit;
- due to thermal degradation of fuel elements (of plastic, ebonite) in the composite fuses, of the switches in the driving cab, there could not find the appropriate positions corresponding to their engagement or initiation as a result of the staff intervention or of a possible short-circuit;
- the regime switch light-heavy in the driving cab had burnt fuel elements in its composition;
- in the area corresponding to the main switch of the locomotive were not find signs of thermal damage;

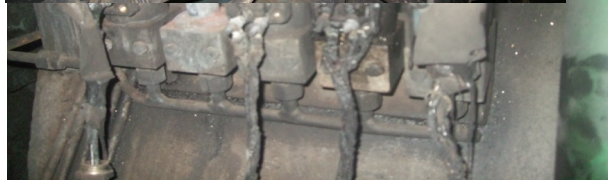


#### condition of the main units

- the diesel engine of the locomotive was not thermally damaged and does not have signs of fuels and lubricants leakages;

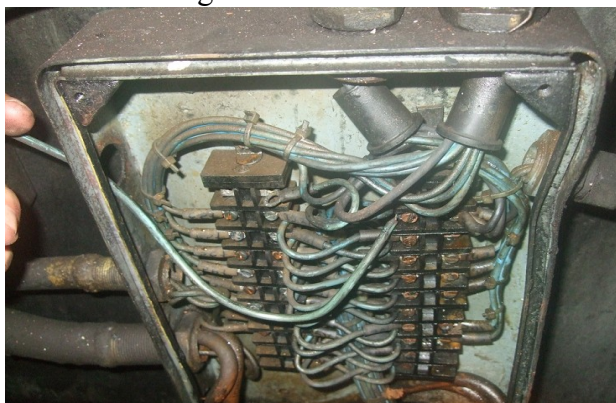


on the covers of the hydraulic transmission, reversing gear, axle attacks 1-4, on the cardan axes were not found signs of thermal damage; on their external sides were found deposits of dirt and oil; at the control valves of the hydraulic transmission was found the thermal damage of the terminal plates, of the coils and related wires, of the air pipes from the pneumatic set and of the Argus tubes that make the connection with the valves S4-S8;



there was missing the coil corresponding to the valve S5 (operation heavy regime), power and control wires hanging on the outer side surface of the transmission and the insulation of the wires and terminals board casing had signs of thermal damage; there were not found specific signs of a short-circuit occurrence;

- between the engine electric dose and the TH dose was found an electric conductor 31 insuring the electric connection (minus) between them and which was mounted outside the electrical wiring tubes, over the hydraulic transmission housing; this had the insulation burnt, excepting portions near and inside the doses;



the compressor, the transfer and lubrication pump, the unit GAT08S2, in normal condition, without thermal damage;

the dynastarter has the terminal block damaged by the thermal influence of the flame from outside, without specific signs of electrical

short-circuit;

- the dynastarter outside housing has slight signs of thermal damage on the lateral upper side;
- there were no signs of replacement or recent intervention at the locomotive respectively units and subsets.

#### condition of the accumulators batteries

- the accumulators batteries from the niche on the right of the locomotive (boxes 5-8) thermally damaged on the upper side, the serial registration flexible connections between the batteries with the insulation thermally damaged, the connection cable between the niche no. 1 and the niche no. 2 with the insulation thermally damaged only on the area located in the niche on the right, melt H



type connections between the elements, the upper seals of the batteries completely burnt;

- there were not found specific signs of the electric short-circuit to the batteries 5-8 from the niche on the right;



➤ condition of the running devices and of the brake shoes

- on the strut of the bogie 1, in the area the wheel on the right of the axle 2 was found the burning of the deposits composed of the mixing of dust with oil products (oil and diesel);
- at the bogie 2 was found the damage of the brake wheelhouse elements and of the wheels of the axle no. 3, in the area located under the channels formed by the main outside struts and the inner struts;
- on the strut of the bogie 2, next to the left wheel of the axle no. 2 was found the burning of the deposits composed of the mixing of dust with oil products (oil and diesel);
- at the axle number 1 was no sign of overheating of the bandages and of the shoes as a result of running with the handbrake tightened;
- at all the locomotive wheels, on the inner and outer sides of the bandages is found the degradation of the paint on the top side of the bandage (next to the running surface) and a superficial layer of freshly formed iron oxide (rust), resulting from the intervention with water for the fire extinguishment.
- on the shoes sides, next to their active surface were not found significant modifications of the material color as a result of the thermal effect occurred during the braking in operation;
- at the shoe on the back of the axle 2 (the right side) was found the formation of a shoulder with height of about 5 mm and width between 15 mm (in the middle of the shoe) and 25 mm (in the end of the shoe), as a result of the shoe placement to the outside of the bandage tread; also were found on the active surface of the shoe material gaps with depths of maximum 1 mm and the diameter between 5-20 mm, the shoe width (measured on its lateral side from the bandage rim) was of 30-35 mm;
- the eccentric position of the shoe from the back of the wheel on the right of the axle no. 2 was as a result of the wears in the braking wheelhouse joints; also were found eccentric positions of the shoes to the rolling surface of the wheels and at the wheels on the left axle 3 and axle 4 right side;
- on the edge between the active surface and the lateral surface of the shoe were found small burrs (max. 1.5 mm);



- at the shoe in front of the wheel on the right of the axle no. 2 was found that the active contact surface (of rubbing with the wheel) had been only 20 % of the active surface of the shoe, the rest of 80% of the surface being covered with oxide mixed with dust; the last intervention at the brake shoes was made during 02-03 of August 2010 at the R2 type revision, some shoes being replaced.

➤ Condition of the fuel tanks



- the auxiliary tank and associated pipe work, free from recent intervention and free of thermal damage, except the oil supply pipe of the unit GAT 08S2 which is affected in the area under the locomotive chassis;
- the main tank on the left shows overpressure characteristic deformations, being also broken two mounting screws of the tank on the main outer strut (to the axle 3);
- the tank on the left was dismantled from the locomotive in Oravita shed to move the locomotive in safe conditions to Timisoara Depot;
- the tank on the left shows three cracks in the joint areas of the tank sides, as a result of the overpressure created by the fire, two on the top side of the tank and one on its bottom side, which led to the entire quantity of diesel leaking from the inside;
- upper level indicators were thermally damaged, at the both tanks;



➤ at the bottom side of the locomotive:

- in the lower area of the big hood, on the right, the air and fuel pipes in the channel formed by the locomotive chassis, the main outside strut on the right and the inside strut on the right under the locomotive are thermally damaged, have signs of burning of the existing deposits, on the entire distance between the pivot sleeper of the bogie 1 (including the area with the collector bags) to the pivot sleeper of the bogie 2;
- the inner sides of the channel formed by the inner and outer struts on the right with the locomotive chassis, have signs of thermal damage with color change and also remains of the burnt deposits on these elements;
- in the area between the top side of the tank on the right and the bottom side of the chassis were found signs of thermal influence and also the damage of the paint on the front and top side of the main tank on the right (in the area of the power mouth);
- on the left of the locomotive, in the area between the top side of the locomotive main fuel tank and the locomotive chassis, up to the area of axle 3 were found signs of thermal damage and burning of the existing deposits ( with color change of all the metallic elements);
- signs of thermal influence on the inner surfaces of the channel formed by the locomotive chassis with the main outer strut on the left and the inner strut on the left up to the area of the pivot sleeper of the bogie 1;



#### **B.5.4.1.2. Data resulted from the documents asked from the railway undertaking**

- the last repair type RR was made on the 20<sup>th</sup> of May 2005 at SC Remarul “16 Februarie” SA Cluj Napoca, until the date of the accident being run a number of 345 494 km;
- the locomotive DHC 80-0172-9 is due to R.G. since May 2008
- the last planned technical overhaul was “R2”+CUS type and was made during 02<sup>nd</sup> -03<sup>rd</sup> of August 2010 at Timisoara Locomotives Repairs Department from SCRL “CFR – SCRL Brasov” SA;
- the last overhaul type PTH3 was made on the 6<sup>th</sup> of September 2010 at Oravita Working Point belonging to Timisoara Locomotives Repairs Department;

### **B.6. Analysis and conclusions**

#### **B.6.1. Analysis of the fire occurrence**

I. Given the above and as a result of the analysis of thermal influence on the areas damaged by the fire, we consider that:

- given the running direction of the locomotive, the fire ignition occurred in the area of the axle no. 2, on the right in the running direction, by ignition of the deposits formed by the mix of dust with oil products on the bottom surface of the chassis, on the inner sides of the main outer strut and the inner longitudinal strut, and also on the air and fuel pipes located above the wheel, by the incandescent material particles (sparks) detached from the shoe, as a result of the service braking in the running of the locomotive;
- the fire spreading to the area above the main tank on the right was made by burning of the deposits composed of the mixture of dust and oil products accumulated from the construction elements of the locomotive mentioned above, under the influence of under the influence of air currents formed at the bottom of the locomotive during its running;
- further, under the effect of the air currents formed at the bottom side of the locomotive while running, there occurred the phenomenon of rolling of the air current between the top surface of the tank on the right and the bottom surface of the chassis which led to the flame spreading to the top surface of the main tank on the left, along the main sleeper of the locomotive; the burning process continued by burning of the deposits on the main sleeper, spreading also on the air pipes of the pneumatic set and Argus tubes that make the connection with the valves S4-8, which it thermally affected.

The spreading process of the burning had as result the smoke release, the phenomenon being noticed by the locomotive staff reason for which actions of stopping the train were taken.

- while the locomotive stationing, the flame became more intense, reaching the area of the air filters for turbocharger air inlet and the fire spread on the surface of big hood roof of the locomotive reaching the area over the air compressor and the front wall separating the big hood and the locomotive cabin;
- the fire spreading phenomenon both to the air filters and to the big hood roof was favored by an air current formed by the opening by the driver assistant of the access door of the dynastarter (left side) from the driving cab;
- from the area of the axle no. 2 the fire spread along the air pipes to the collector bags, entering the space under the driving station floor and also locomotive cabin along the pipelines on which are located the insulation valves for FD and KD2.
- Due to temperature increase in the area of the separating wall between the big hood and the driving cab, and also in the area of the floor on the right of the driving station, given the flame penetration through the access door of the dynastarter and through the area of the pipelines on which are mounted the insulation valves of FD and KD2, there occurred the ignition of the fuel elements inside the cabin (floor, side walls cushioning, ceiling) with damage to all equipments and installations in the driving cab; the thermal effect produced inside the cabin led to the damage of the top side of the accumulators batteries located in the niche on the right of the locomotive (the accumulators batteries 5-8).

II. As a result of macroscopic and microscopic metallographic analysis and determination of chemical composition shoe that was located on the back of the right wheel of the axle no. 2 from the locomotive DHC 80-0172-9 (marked and identified in the Laboratory of Rolling Stock of the Romanian Railway Notified Body with the code 3051-117-2) was prepared the Test Report no. 3051-117 from the 10<sup>th</sup> of November 2010 regarding *“the determination of the physico-chemical characteristics of the brake shoes type P10 of phosphorous cast iron, series 051213 from the locomotive DHC 80-0172-9, involved in the fire on the 08<sup>th</sup> of September 2010, on the section Oravita – Berzovia”*.

According to the Test Report no. 3051-117 from the 10<sup>th</sup> of November 2010, at the shoe coded 3051-117-2 were found the following:

- casting defects on the friction surface:
  - on the friction surface:
    - two small blows in the marginal area of the friction surface with diameters of 2.0 mm and 7.0 mm whose amount of areas < 5% of the shoe surface;
    - maximum depth of the defects max. 2.5 mm;
  - cross-sectional: in the center of sections and around the reinforcement rail, blows with diameters from 1.5 mm to 9.0 mm and depths from 2 mm to 16 mm.

According to the characteristics required by C.S no. 1/SFMR/SDT/2000, rev.2 “Brake shoes for rolling stock and trailers” elaborated by SNTFC “CFR Calatori” SA, the casting defects (shrinkage pipes and blows), excepting the metallic and nonmetallic inclusions, are admitted on the friction surface of the shoes (except in the center) and cross section (after braking at shock) within the following limits:

- a single defect with the diameter max 10 mm;
- more defects with diameters  $< 10\%$  and whose amount of areas to be  $< 5\%$  of the shoe surface;
- maximum depth of the defects  $< 3$  mm.

➤ defects on the other surfaces:

- local pits and pores with depths of max. 3 mm;

According to the characteristics required by C.S no. 1/SFMR/SDT/2000, rev.2 “Brake shoes for rolling stock and trailers” elaborated by SNTFC “CFR Calatori” SA, on the other surfaces are admitted local pits with depth of max. 6 mm, width of max. 15 mm and length of max. 50 mm.

## **B.7. The accident causes**

### **B.7.1. Direct cause**

The fire occurred by the ignition of existing oil deposits in the area located above the wheel on the right of the axle no. 2 in the running direction of the locomotive (on the air and oil pipes, on the inner sides of the stringers, main outer and longitudinal inner, and on the bottom side of the chassis), by the incandescent material particles (sparks) detached from the shoe located on the back side of the right wheel from the axle no. 2 as a result of the service braking during the running of the locomotive.

### **Contributing factors**

- the existence of the oil products in the areas of construction sealing of the installations located at the bottom side of the locomotive and their deposit in hardly accessible areas;
- the existence of wears in the transmission parts joints, of the braking effort through the locomotive braking wheelhouse, which led to the shoe application outside of the wheel tread and also the uneven transmission of the braking efforts to the two shoes corresponding to the right wheel from the axle no. 2.

These factors were determined by the wear condition of the locomotive installations and units, as a result of missing the deadline of the specific works for the repair type to which the locomotive was due (due to RG type repair since May 2008).

### **B.7.2. Underlying cause**

None.

### **B.7.3. Root causes**

None.

## **C. Safety recommendations**

The safety recommendations aim to solve the next issues:

- 1 Compliance with the deadlines to put in planned repairs the locomotives;
- 2 Regular cleaning of the fuel residues accumulations from the areas inclined to accidental ignition of the locomotive, tasks to be included in the technological processes of the periodic inspections;
- 3 Checking the brake wheelhouse at the hydraulic diesel locomotives to detect wears in joints and take control measures at technical planned revisions.

The addressees of the safety recommendations are: National Society of Railway Passengers Transport “CFR Calatori” SA and “CFR – SCRL Brasov” SA.

This investigation report will be sent to Romanian Railway Safety Authority, to National Society of Railway Passengers Transport “CFR Calatori” SA and to “CFR – SCRL Brasov” SA.

According to the provisions of the Law no. 55/2006 on the railway safety, Romanian Railway Safety Authority will monitor the implementation of these recommendations.

Members of the investigation commission:

• Bobe Cristian - main investigator \_\_\_\_\_

• Oltenacu Livius – member \_\_\_\_\_

• Fleancu Constantin - member \_\_\_\_\_