



MINISTRY OF TRANSPORTS AND INFRASTRUCTURE
ROMANIAN RAILWAY AUTHORITY - AFER

ROMANIAN RAILWAY INVESTIGATING BODY



INVESTIGATING REPORT

on the fire occurred on the 6th of June 2011

on the range of CF Timisoara Regional Branch, between h.m. Bocsig and the railway
station CFR Ineu

at the locomotive DA 60-0930-2 (belonging to SNTFC “CFR Calatori” SA)

hauling the Passenger train no. 3134



Final edition
the 28th of July 2011

NOTICE

With reference to the accident occurred on the 6th of June 2011, at 7:20p.m., on the current line between the railway station CFR Ineu and the flag station Bocsig (km. 44+350), consisting of a fire at the electric diesel locomotive DA 60-0930-2 hauling the Passenger train no. 3134, 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, *the 28th of July 2011*

Approved by
Dragos 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
Nicu PĂLÂNGEANU

This approval is part of the Report for the investigation of the accident occurred on the 6th of June 2011, on the range of activity of CF Timisoara Regional Branch, the running section Brad-Arad (simple line non-electrified), between the railway station CFR Ineu and the flag station Bocsig (km. 44+350) consisting of a fire at the electric diesel locomotive DA 60-0930-2 hauling the Passenger train no. 3134 (belonging to SNTFC “CFR Calatori”).

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I. PREAMBLE

I.1. Introduction

The accident occurred on the 6th of June 2011, at 7:20 p.m., in the running of the train no. 3134, consisting of a fire at the towing locomotive DA 60-0930-2, is an accident according to 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.

Taking into account those above mentioned and according to 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 6th of June 2011, Romanian Railway Investigating Body was notified by the Regional Inspectorate for Traffic Safety of CF Timisoara Regional Branch by the investigator responsible in the territorial structure, about the occurrence of a railway accident in current line between the railway station CFR Ineu and the flag station Bocsig (km. 44+350), in the running of the passenger train no. 3134, consisting of a fire at the locomotive DA 60-0930-2 hauling the train.

After moving to the place of the accident, it observed:

- the electric diesel locomotive DA-60-0930-2, hauling the Passenger train no. 3134, was stopped at the km. 44+350 between the railway station CFR Ineu and the flag station Bocsig;
- the locomotive box, on the area between the main diesel tank and the driving station no. II, was thermally affected on the right and on the left side;
- the electric installation, the monitoring and control devices, the elements of laminated PFL on the inside walls and the floor of the driving station II of the locomotive were burnt;
- the power wiring of the traction engines no. 4, no. 5 and no. 6 had burnt insulation on the portion between their housings, the connection doses and until the entry in the wiring channel;
- the insulation of the control wiring, the flexible joints and rubber gaskets of the installations of fuel, lubrication, cooling and hydrostatic in the engines box, burnt.
- the auxiliary aggregates in the area of the driving station II (transfer and pre-lubrication electro-pump, the electromotor of the forced ventilation II, the water pump, the hydrostatic installation pump), thermally affected;
- the radiator elements strongly thermally affected;
- the panel with the indicator devices for monitoring the operational parameters of the diesel engine, entirely burnt;
- the line and the installations in the area of the accident were not affected.

No deaths and injuries.

At the accident place were present the representatives of:

- Inspectorate for Emergency Situations “Vasile Goldis” Arad - Section Ineu;
- Operative Department of Railway Transports Police;
- Romanian Railway Investigating Body;
- Romanian Railway Safety Authority – Inspectorate for Railway Safety Timisoara;
- National Railway Company “CFR” SA - CF Timisoara Regional Branch;
- National Company of Passenger Railway Transport “CFR Calatori” SA - RTFC Banat-Oltenia.

Through the Decision no. 60 from the 7th of June 2011 of the OIFR Director, 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 of:

- Livius Oltenacu – OIFR investigator - main investigator
- Constantin Fleancu – Head of SC PM AII – RTFC Banat – Oltenia - member
- Sorin Cîrdu – regional inspector SC – RTFC Banat – Oltenia - member
- Mircea Zugravu – regional inspector SC – RTFC Banat – Oltenia - member.

A. BRIEF PRESENTATION OF THE ACCIDENT

A.1. Brief presentation

On the 6th of June 2011, the Passenger train no. 3134 running on the section Brad-Arad, was towed with the locomotive DA-60-0930-2. At 7:20 p.m., running on the current line between the railway station CFR Ineu and the flag station Bocsig, at the km. 44+350, a fire occurred at the locomotive on the right in the running direction, in the area of the traction engines no. 4 and no. 5, fire that expanded in the engines box and to the driving station no. II.

Unable to localize and extinguish the fire, the guard called by his personal phone the unique emergency number 112 and asked for the intervention of the Firemen and of the Inspectorate for Emergency Situations and the fire had been extinguished at 8:40 p.m.

The locomotive DA-60-0930-2, hauling the Passenger train no. 3134, belongs to SNTFC “CFR Calatori” SA – RTFC Banat – Oltenia and was driven in simplified system by locomotive driver.

The area of the railway accident is located on the running section Brad - Arad, belonging to CNCF “CFR”-SA – CF Timisoara Regional Branch. The accident occurred at the km. 44+350 on the current line between the railway station CFR Ineu and the flag station Bocsig (line in alignment, with slope of 0.5 ‰ in the running direction).

A.2. Causes of the accident

A.2.1. Direct cause

Release of sparks from the electrical discharges between the conductor 778 (of serial registration of the electric traction engines no. 2 and no. 5) and the conductor 781 (of connection with the drive inverter), followed by the ignition of the combustible deposits accumulated over time from the locomotive operation and the flame propagation to the supply wiring of the electric traction engines no. 4, no. 5 and no. 6, which led to the fire expansion in the engines box and in the driving station no. II.

Contributing factors

Missing of a portion of the fireproof insulation mantle of about 80 mm on the conductor 778 of serial registration of the electric traction engine no. 2 with the electric traction engine no. 5, in the area placed at the entry in the yoke of the wiring channel, under the existence of the direct contact with the conductor 781 that had the insulation aging, favored the initiation of the fire occurrence.

Aging of the power wiring insulation and the existence of losses of oil, diesel, gas as consequence of the leakage of the connections from the concerned installations, in terms of missing the deadline of the specific works to the repair type to which the locomotive was due, which favored the fire propagation.

A.2.2. Underlying causes

There were not complied the measures provided by the document 45/g/2038/2004 of the Locomotives Modernization Service of S.N.T.F.C. “CFR. Calatori” S.A. regarding the measures of prevention of fires beginning occurrences on the occasion of performing the repair type RR at the locomotive DA-60-0930-2 on the 29th of September 2005 at SC RELOC SA Craiova;

There was not complied the cycle of mandatory repairs at the locomotive, according to the provisions of the *Railway Norm "Railway vehicles. Inspections and planned repairs" no. 67-005 from 2008* approved by OMT no. 364/2008, in that the locomotive was due to repair type RG since September 2010 (at 4 ±1 years) and with the norm of kilometers between 2 repairs overdue (435 820 km since the 7th of June 2011 to 400 000 km between 2 repairs for LDE 2100 CP).

A.2.3. Root causes

None.

A.3. Severity level

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

A.4 Safety recommendations

None.

This investigation report will be sent to Romanian Railway Safety Authority, to the National Company for Passenger Railway Transport “CFR Calatori” SA, to the National Railway Company “CFR” SA and to the Locomotives Repair Company “CFR SC RL Brasov” SA.

B. INVESTIGATING REPORT

B.1. Description of the accident

For towing of the Passenger trains no. 3123/3134 from the 5th-6th of June 2011 on the section Arad – Brad – Arad was ordered the locomotive DA-60-0930-2, driven by locomotive teams in simplified driving.

On the 6th of June 2011, at the Passenger train no. 3134 running on the section Brad – Arad, in the railway station CFR Gurahont was performed the change of traction staff. The locomotive driving being performed from the driving station no. II, at the train departure from the flag station Tamand to the railway station CFR Ineu, the locomotive driver noticed a smoke release in the engines box and flame outside the locomotive on the right (in the running direction), in the area of the bogie no. II and of the traction engines no. 4 and no. 5, reason for which he took actions of quick stopping the train.

The train stopped at the km. 44+350 and the locomotive driver together with the train staff tried to localize and extinguish the fire initiated at the bottom side of the locomotive, next to the traction engines no. 4 and no. 5, using the fire extinguishers in the equipment of the locomotive and of the coaches.

As the fire could not be localized and extinguished by the train staff with the means available in the equipment and finding the rapid propagation of the fire, the guard called from the mobile phone the unique emergency number 112.

There were no deaths or injuries.





Fire effects on the equipments in the engines box.



Fire effects on the equipment of control, indication and protection in the driving station no. II

The intervention plan of rescue and emergency services

At 7:23 p.m. were notified the military firemen belonging to the Inspectorate for Emergency Situations Arad - Section Ineu who intervened from 7:45 p.m., the fire being extinguished at 8:40 p.m.

The current line Bogsig - Ineu was reopened to traffic at 10:43p.m.

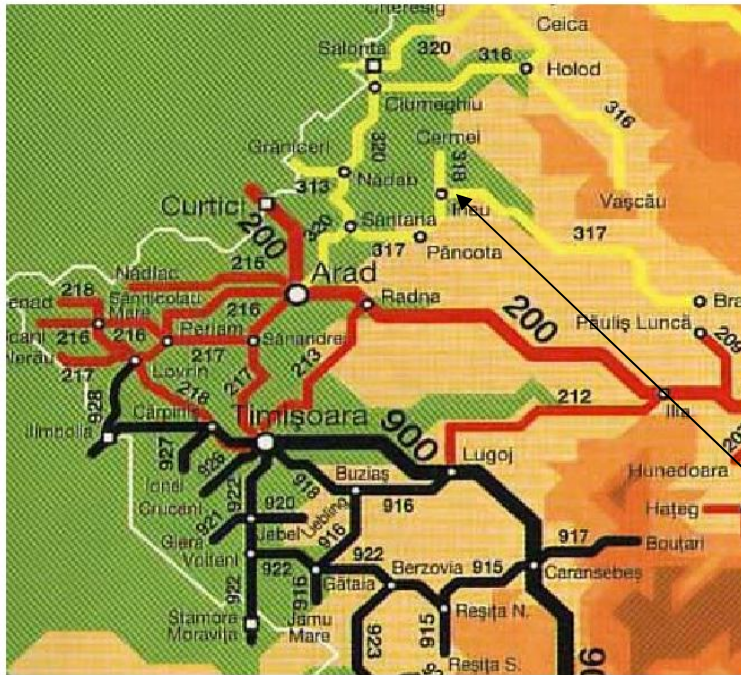
B.2. Circumstances of the accident

B.2.1. Involved parties

2.1.1 The involved staff belongs to Arad Locomotives Depot of the National Company of Passenger Railway Transport "CFR Calatori" SA – RTFC Banat – Oltenia.

2.1.2 The locomotive DA 60-0930-2 is the property of SNTFC "CFR Calatori" – SA and is maintained by the staff of Arad Repairs Section of "CFR SC RL Brasov" SA.

2.1.3 The railway infrastructure on which the accident occurred belongs to CNCF "CFR" SA – Timisoara Regional Branch and is maintained by the staff of District 12 Ineu of the Section L8 Arad.



Geographical location of the accident

2.1.4 The installation of railway communications on the involved locomotive is the property of SNTFC “CFR Calatori” – SA and is maintained by staff of Arad Repairs Section belonging to “CFR SC RL Brasov” SA.

The investigation commission questioned the employees involved in driving the involved locomotive, the staff who served the passenger train no. 3134 and took statements from the staff assisting the train.

B.2.2. Forming and equipments of the train

The passenger train no. 3134 was composed of 3 coaches, 12 axles, having 146 gt, braked weight according to the service book – automatic 92 t, by hand 9 t and in fact - automatic 203 t, by hand 68 t and was towed by the locomotive DA 60-0930-2, the driving being provided by simplified team formed of locomotive driver.

The locomotive DA-60-0930-2 involved in the accident belongs to the railway undertaking SNTFC “CFR Calatori” – SA being in operation of Arad Locomotives Depot of RTFC Banat – Oltenia.

The safety and vigilance equipment (DSV), the equipment for the point control of the speed and hitchhiking (INDUSI) in locomotive equipment at station I were in function and at station II were destroyed by the thermal effect during the fire.

B.2.3. Railway equipments

The involved railway infrastructure is managed by CNCF “CFR” SA – CF Timisoara Regional Branch and is maintained by the staff of District 12 Ineu of the Section L8 Arad.

The current line between the railway station CFR Ineu and the flag station Bocsig, in the area of the km. 44+350 is non-electrified, in alignment with a slope of 0.5‰ in the running direction, built with rail type 54, on reinforced concrete sleepers T13.

B.2.4. Means of communication

The communication between the driver and the movements inspectors was ensured through radio-telephone equipments.

B.3. Consequences of the accident

B.3.1. Deaths and injuries

None.

B.3.2. Material damages

Following the fire, the damage and expenses incurred amounted to **74 684.35 lei**, detailed as follows:

- at the locomotive – according to the estimate no. 190/1481/2011 of Section SC RL Arad, amounted to 73 818.42 lei;
- train delays – according to the estimate no. 227/1/2011 of CF Timisoara Regional Branch – Arad Traffic Controller, amounted to 865.93 lei ;
- at the lines – none;
- at the installations – none;
- at the environment – none;

B.3.3. Consequences of the accident in railway traffic

The current line on the distance between the railway station CFR Ineu and the flag station Bocsig was closed for traffic between 7:20 p.m. and 10:43 p.m.

The passengers from the passenger train no. 3134 had been taken over by the additional train G 18390, being transported to the railway station CFR Ineu.

Train delays:

Following the occurrence of this accident a passenger train was delayed by 197 min.

B.4. External circumstances

On the 6th of June 2011, at the time of the railway accident the visibility was good, clear sky, moderate wind, air temperature of about 30⁰ C.

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

The accident occurred in current line simple non-electrified between the railway station CFR Ineu and the flag station Bocsig, in the area of the km. 44+350, in alignment with a slope of 0.5‰ in the running direction, built with rail type 54, on reinforced concrete sleepers T13.

B.5. Investigation course

B.5.1. Summary of the involved staff statements

B.5.1.1. Summary of the railway undertaking staff statements

The locomotive driver who drove the locomotive DA-60-0930-2, on the 6th of June 2011, stated as follows:

- he was ordered for towing the train 3134 on the section Gurahont-Arad with the locomotive DA-0930-2;
- he took over the service in the railway station Gurahont and the technical condition of the locomotive DA-0930-2 was good;
- after leaving from h.Tamand arriving to the km. 44+300 he noticed a smoke release under the culverts of the locomotive and the auxiliary heater and in the rearview mirror a flame between the bogie II and the locomotive box;
- he took actions of quick stopping the train, he turned off the diesel engine and disconnected the switch of the batteries pack;
- together with the train staff acted with the fire extinguishers in the equipment of the locomotive and of the coaches and the guard asked by calling 112 the intervention of the military firemen;
- they acted with the fire extinguishers on the right of the locomotive in the running direction between the axles 4 and 5;
- he fail to enter the engines box because of the thick and stifling smoke;
- the firemen arrived at the place of the accident after about 25-30 minutes;

The locomotive driver who gave over the locomotive DA-0930-2 in the railway station Gurahont on the 6th of June 2011, stated as follows:

- he served the locomotive DA-0930-2 on the section Gurahont-Arad on the 5th of June 2011 and on the section Arad-Brad-Gurahont on the 6th of June 2011;
- the grounding switches 34.1-3 were in normal position and sealed;
- during the towing of the trains from the 5th-6th of June 2011 at the locomotive were no grounding signals, no current differences on the traction engines groups or irregularities in the operation of the main generator;
- he gave over the locomotive on the 6th of June 2011 in the railway station Gurahont in a good technical condition;

The guard on duty at the train 3134 on the 6th of June 2011, stated as follows:

- after the departure of the train 3134 from h.Tamand he noticed on the window a smoke release from the locomotive on the right in the running direction and at the same time the locomotive driver braked the train;
- together with the conductor and the locomotive driver he tried to extinguish the fire at the locomotive with the fire extinguishers from the coaches and locomotive and he announced the military firemen with his mobile phone at 112;
- the fire was on the right of the locomotive under the driving station in the running direction;
- he tried with the conductor to untie the locomotive from the first coach but he failed, the he untied the coach 1 from the coach 2 and after the arrival of the firemen he managed to untie also the first coach by locomotive;
- he took actions to descend the passengers from the train;
- the coaches in the train were not affected by the fire;
- the military firemen arrived at the place of the fire at 7:40 p.m.;
- the wind was blowing quite strong from the left in the running direction;

The conductor on duty at the train 3134 on the 6th of June 2011, stated as follows:

- during the running between h.Tamand and the railway station CFR Ineu, being at the last coach of the train he noticed that the train had stopped in current line;
- he went out to the door of the last coach and the guard shouted him to bring the fire extinguishers from the coaches because the train locomotive was in fire;
- he participated together with the guard and the locomotive driver at the fire extinguishment and to the detach the coaches from the locomotive;
- after the arrival of the military firemen called by phone by the guard at 112 he managed the sale of the locomotive coupling from the first coach;
- he acted with the fire extinguishers on the right of the locomotive between the box and the front bogie;
- the wind was blowing from the left in the running direction;
- he took actions to descend the passengers from the train;
- the military firemen arrived at the place of the fire after about 10-15 min. from the notification;

The assistance staff of the train 3134, stated as follows:

- according to the provisions of the document 20/31/LE/03.06.2011 of SNFTC he performed on the 6th of June 2011 the assistance of the train 3134 on the distance Sebes – Arad in the composition of the train;
- he found the emergency stop of the train in current line between h. Tamand and the railway station CFR Ineu;
- at the train stop he noticed a strong smoke release and flames at the towing locomotive, at the bogie II on the right in the running direction;
- he participated together with the train party to localize and to extinguish the fire with the fire extinguishers in the equipment until the arrival of the military firemen notified by phone by the guard through 112;

B.5.2. Safety management system

The infrastructure manager CNCF “CFR” SA and the railway undertaking SNTFC “C.F.R. Calatori” SA had established 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 soon after the railway accident by the members of the investigation commission;
- photos with the locomotive subassemblies taken in Arad Depot;
- the railway norm "Railway vehicles. Inspections and planned repairs" no. 67-005 from 2008 approved by OMT no. 364/2008;
- the plan of measures 45/g/2038/20.09.2004 of Locomotives Modernization Service of SNTFC “CFR Calatori” SA;
- statements and questionings of the driving staff of the locomotive DA-0930-2 and of serving staff of the train 3134;
- 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 responsible with its maintenance;
- inspection and interpretation of the technical condition of the elements involved in the accident;
- documents of release of the train.

B.5.4. Work of the rolling stock

B.5.4.1. Data found on the locomotive DA-0930-2:

B.5.4.1.1. Data resulted from the checks made during the period 7th-10th of June 2011 by the investigation commission and the maintenance and repairs staff of Arad Repairs Section and registered in a minutes (part of the investigation file) and photos (taken by the investigation commission)

Following the checking of the investigation commission at the locomotive, one found out:

Condition of the electric traction engines

The electric traction engines no. 4, no. 5 and no. 6, had the supply wiring thermally affected. They did not have inside signs of short-circuit, insulators flashover or insulation piercings



The supply conductors of the electric traction engines no. 4, no. 5 and no. 6 did not have signs of overheating in the area of the pads fixing and of conductors crimping in the pads.

The wiring of series registration and supply of the electric traction engines no. 4 and no. 5 had burnt insulation between the fixing pads in the doses and the fixing yokes in the wiring channel.



At the conductor 778 of serial registration of the electric traction engine no. 2 with the electric traction engine no. 5 was found **a segment of missing insulation of about 80 mm at the entry in the yoke of the wiring channel**. The non-insulated portion was in contact with the conductor 781, the other supply cables of MT4 and MT5 showing thermally damaged insulation.



The conductor 778 of serial registration of the electric traction engines no. 2 and no. 5, with the portion of 80 mm of missing insulation at the entry in the yoke of the wiring channel



The conductor 778

The conductor 781

The electric traction engines no. 1, no. 2 and no. 3 were technically appropriate, without thermal affectation.



On the frames of the bogie no.1 and on the side unaffected thermally of the bogie no.2 and also the bottom side of the locomotive chassis, the power wiring, at the findings after lifting in winches, there were deposits of dust mixed with oil products.

The main tank without thermal affectation, was sealed and did not show signs of recent intervention.

The electric engine of forced ventilation associated to the bogie no. 2, without signs of short-circuit, with the insulation and the inside wiring thermally affected as consequence of the external fire and without friction between the turbines-housings.

The electric engine of the water pump and of the transfer pump, without signs of short-circuit, with the insulation and the inner wiring thermally affected as consequence of the external fire.

There were not found signs of short-circuit, cuts in the areas of pads to any of the power cables.



Condition of the gear from the devices block

- the side towards the driving station unaffected by the fire having appropriate contactors and gear, without signs of flaming;
- the maximal current relays poz.54.1-3 were sealed without being active;
- the grounding circuits switches 34.1-3 in connected position, not sealed;
- the covers of the relays R13 have deformations due to the high temperature, without beadings or melting of the contacts;
- the side towards the outside of the locomotive – outside resistances appropriate, unaffected thermally ;
- the fuses G2, G4 appropriate and at the prescribed values;
- were checked the compressor, the main generator and there were not found causes generating fire.

The auxiliary aggregates in the area the most affected by the fire were dismantled from the locomotive to be performed detailed findings (the electro-pump of transfer and pre-lubrication, the motoventilator pc II, the position 90.2, the water electro-pump).

After dismantling from the locomotive and disassembling in the workshop of the three electro-motors were found the following issues:

- the housing of the electro-motor of acting the pump of transfer and pre-lubrication had slight signs of thermal affectation, without signs of short-circuit, flames, inside flashovers;



- the engine of forced ventilation of the bogie no. 2 had signs of thermal affectation outside and inside the housing, without signs of short-circuit, flames, inside flashovers;

- the electro-motor of the water pump shows strong signs of thermal affectation inside and outside and also the terminals box, without signs of short-circuit, flames, inside flashovers;



After dismantling of the culverts in the engines box were not found at the locomotive wiring to supply the electric traction engines signs of short-circuit or thermal affectation on the portion placed before the exit from the area of the locomotive floor.



Condition of the batteries pack

- the batteries pack and the compartment where these are placed, the insulation of the flexible serial registration connections between the boxes did not show signs of short-circuit or thermal affectation;



Condition of the electric cables associated to the electric traction engines after the fire:

- the wiring channel of the locomotive was dismantled from the side door of the engines box to the entry in the driving station no. II, where were found the power cables unaffected thermally, the control and supply wiring of the auxiliary services having the insulation affected to the upper side because of the

contact with the metallic covers overheated by the fire. There were not found overheating or melting of cables due to the thermal effect of the electric current.

B.5.4.1.2. Data resulted from the analysis of the documents asked from the railway undertaking

- the last repair type RR was performed on the 29th of September 2005 at SC RELOC SA Craiova;
- the locomotive was transferred from the locomotive park of Galati Depot to the park of Arad Depot on the 7th of December 2006 according to the document 10/32/g/1933/07.12.2006 of Bucharest Locomotives Modernizations and Repairs Service;
- the locomotive DA-0930-2 is due to RG since September 2010 and rescheduled for May 2011 according to the timetable established under the document SMLARE Bucharest no. 10/42/g/1579/02.12.2010;
- the last technical planned inspection type “R1” was performed on the 12th-13th of May 2011, at Arad Locomotives Repairs Section. Before this inspection, at the locomotive was performed an inspection type RT on the 15th of March 2011.
- The last inspection type PTH3 was performed at Arad Repairs Section on the 5th of June 2011.

B.6. Analysis and conclusions

B.6.1. Analysis of the fire occurrence

Release of sparks from the electrical discharges between the conductor 778 (of serial registration of the electric traction engines no. 2 and no. 5) and the conductor 781 (of connection with the drive inverter), in the area of exit of the cables associated to the electric traction engines no. 4 and no. 5, in the area placed after the yoke of their fixation on the locomotive chassis. This was possible due to a portion of missing insulation of about 80 mm from the conductor 778, that was in direct contact with the conductor 781 showing aged insulation.

The fire developed on the bottom side of the locomotive box and of the frame of the bogie no. 2 affecting the ventilation bellows and the supply wiring from the electric traction engines no. 4, no. 5 and nr. 6. As consequence of the air currents while running, the flame entered the engines box in the area placed over the bogie no. 2, igniting the oil residues accumulated over time in this area.

The subsequent propagation of the fire was caused by successive ignition of the wirings insulation, of the elements of connection and rubber gaskets existing in the engines box. Burning was maintained also by the combustible deposits from under the floor of the engines box and the driving cabin station II and also of the oil in the hydrostatic installation. Also, the fire was maintained by burning of the combustible elements (wirings insulation, floor, trim, etc.) inside the driving cabin at station II and outside.

Inside the channel between the bogie no. 2 and the devices block, the power and command cables had intact insulation, without signs of short-circuit or thermal influence.

The metallic parts of the engine group diesel – generator had the paint affected, but without deformations or major degradations of the structural strength.

The traction engines, the electric machines associated to the auxiliary services, the supply and command cables checked at their dismantling in Arad Repairs Section, did not show signs of short-circuit, cuts or local melting initiating the fire.

There were checked by dismantling the turbines and the covers from the forced ventilation of the electric traction engine from the bogie no. 2 and there were not found signs of friction generating sparks.

From the locomotive documents does not result on which occasion was replaced power wiring and the cables type, the constructive solution being with simple cables of serial registration and supply of the engines and not with double cables (2 x 150 mm).

Even the locomotive was introduced in the repair type RR at SD RELOC SA Craiova in May 2005, in the technical book of the locomotive are not mentioned the additional works made at the repair type RR

performed at SC RELOC Craiova which had been ordered according to the “Plan of measures” no. 45/g /2038/20.09.2004 of Bucharest Locomotives Modernizations Service of SNTFC “CFR Calatori” Bucharest.

During the investigation were also found the following:

1. Regarding the point 1, paragraph 2.1 of the Plan of measures, on the repositioning of the diesel drain pipe after the valve 540, with direct entry in the main tank and not in the auxiliary one, as realized in present – ***the work was not performed.***
2. Regarding the point 1, paragraph 2.2 of the Plan of measures, on the cut of the metallic neck from the floor (yoke) and the replacement of the wooden fixing bracket with one of RELON P; bundling of the supply cables MT4 and MT5 with external PVC tube – mounting of a shrinkable tube (PVC plasticized inflatable, Ø26 / Ø30) on each supply cable of the traction engines, from the exit from the wiring channel to the entry in the terminals box, replacement of the supply cables MT4 and MT5 at each RR, RG, RGgr - was ***partially*** performed, namely – ***the fixing bracket remained of wood, not of RELON P***, were mounted covers of PVC, but **on the conductor 778 is missing a portion of about 80 mm from the fireproof insulation mantle, just at the exit from the wiring channel, in the wooden yoke.**
3. Regarding the point 1, paragraph 2.3 of the Plan of measures, on the additional sealing of the terminals boxes from the MT4 and MT5, with Loctite applied at the tightening screws of the brackets, at the fixing screws of the covers and at the sealing of the terminals box cover – ***the work was not performed.***
4. Regarding the point 1, paragraph 2.4 of the Plan of measures, on the mounting of an insulating collar height of 2 cm. at the ventilation hole to stop the diesel and oil infiltration in the wiring channel – ***the work was not performed.***
5. Regarding the point 1, paragraph 2.5 of the Plan of measures, on the mounting of some fix collection pipes, equipped with draining pipes, under the aggregates where are found important losses of diesel, water and oil (the transfer pump, the main air tank, etc.) – ***the work was not performed.***

According to the point 1 of the Plan of measures, regarding the inappropriate achieving of the grounding protection and the occurrence of the fire beginnings, the grounding protection (power circuit) was made with relay type KUNKE – variant INDA, the locomotive being equipped with installation type EPSAI – INDA.

Because of burning of the driving cabin station II from where the train had been driven, all the accompanying documents (the roadmap, the logbook, the train fiche) were destroyed by burning.

B.7. Causes of the accident

B.7.1. Direct cause

Release of sparks from the electrical discharges between the conductor 778 (of serial registration of the electric traction engines no. 2 and no. 5) and the conductor 781 (of connection with the drive inverter), followed by the ignition of the combustible deposits accumulated over time from the locomotive operation and the flame propagation to the supply wiring of the electric traction engines no. 4, no. 5 and no. 6, which led to the fore expansion in the engines box and in the driving station no. II.

Contributing factors

Missing of a portion of the fireproof insulation mantle of about 80 mm on the conductor 778 of serial registration of the electric traction engine no. 2 with the electric traction engine no. 5, in the area placed at the entry in the yoke of the wiring channel, under the existence of the direct contact with the conductor 781 that had the insulation aging, favored the initiation of the fire occurrence.

Aging of the power wiring insulation and the existence of losses of oil, diesel, gas as consequence of the leakage of the connections from the concerned installations, in terms of missing the deadline of the specific works to the repair type to which the locomotive was due, which favored the fire propagation.

B.7.2. Underlying causes

There were not complied the measures provided by the document 45/g/2038/2004 of the Locomotives Modernization Service of S.N.T.F.C. “CFR. Calatori” S.A. regarding the measures of prevention of

fires beginning occurrences on the occasion of performing the repair type RR at the locomotive DA-60-0930-2 on the 29th of September 2005 at SC RELOC SA Craiova;

There was not complied the cycle of mandatory repairs at the locomotive, according to the provisions of the *Railway Norm "Railway vehicles. Inspections and planned repairs" no. 67-005 from 2008* approved by OMT no. 364/2008, in that the locomotive was due to repair type RG since September 2010 (at 4 ± 1 years) and with the norm of kilometers between 2 repairs overdue (435 820 km since the 7th of June 2011 to 400 000 km between 2 repairs for LDE 2100 CP).

B.7.3. Root causes

None.

C. Safety recommendations

None.

This investigation report will be sent to Romanian Railway Safety Authority, to the National Company for Passenger Railway Transport “CFR Calatori” SA, to the National Railway Company “CFR” SA and to the Locomotives Repair Company “CFR SC RL Brasov” SA.

Members of the investigation commission:

- | | |
|---|---------------------|
| • Livius Oltenacu – OIFR investigator | - main investigator |
| • Constantin Fleancu – Head of SC PM AII – RTFC Banat – Oltenia | - member |
| • Sorin Cîrdu – regional inspector SC – RTFC Banat – Oltenia | - member |
| • Mircea Zugravu – regional inspector SC – RTFC Banat – Oltenia | - member |