



MINISTRY OF TRANSPORTS AND INFRASTRUCTURE
ROMANIAN RAILWAY AUTHORITY - AFER

ROMANIAN RAILWAY INVESTIGATING BODY



INVESTIGATING **R**EPORT

On the fire occurred at the locomotive DA 60-1361-9
owned by SNTFM “CFR Marfa” SA, circulating as locomotive pushing the train
no. 53598, in range of the Regional Branch CF Constanta,
between h.m. Borcea Branch and railway station Ovidiu



Final EDITION

The 2nd of February 2011

NOTICE

With reference to the railway accident occurred on the 30th of September 2010, at 14:08, in the running of the train no. 53598, hauled by the electric locomotive EA 533 in head and DA 1361 pushing, consisting in a fire in the engine box, the traction motors 4 and 5, the current line wire I Fetesti-Ovidiu, between hm. Borcea Branch and railway station Ovidiu, at the km 153+000. 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 2nd of February 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
Sorin CONSTANTINESCU

This approval is part of the Report for the investigation of the accident occurred on the 30th of September 2010, in range of the Regional Branch CF Constanta, in the running of the train no. 53598 belonging to SNTFM “CFR Marfa”, the running section Fetesti-Ovidiu, current line wire I (double-track electrified) between hm. Borcea Branch and railway station Ovidiu, at the km 153+000, consisting in a fire at the pushing locomotive DA 60-1361-9.

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I. PREAMBLE

I.1. Introduction

The fire occurred on the 30th of September 2010, at 14:08, in the running of the train no. 53598, at the pushing locomotive DA 60-1361-9 (structural sub-system – railway vehicle), 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

Soon after the accident, Romanian Railway Investigating Body was notified verbally and in written about it by CNCF “CFR” SA – Traffic Safety Regional Inspectorate of Constanta.

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

- the locomotive DA-60-1361-9 circulated in the composition of train no. 53598 as pushing locomotive from Saligny-East station to Fetesti; it was stopped on the current line wire I (km 153+000), on the section I and II AD between hm. Borcea Branch and the railway station Ovidiu;
- electrical installation and the trim of the locomotive driving cabs were burned;
- power wiring of the traction engines no. 4 and 5 with the insulation burned between their housing, the log dose and until the entry into the trunk;
- control wiring insulation, flexible couplings and rubber gaskets of the installation of fuel, lubrication and cooling from the engine box were burned;
- no damages at the lines and equipments in the accident.

No deaths and injuries.

At the accident place were present the representatives of:

- Inspectorate for Emergency Situations from Ialomita County, Fireman Point Fetesti;
- Operative Department of Railway Transports Police;
- Romanian Railway Investigating Body;
- Romanian Railway Safety Authority;
- CNCF “CFR” SA;
- SNTFM “CFR Marfa” SA.

So, through the decision of the OIFR Director no. 34 from the 4th of October 2010, 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:

- Cristian BOBE – head of IAFG - OIFR - main investigator
- Marin DRĂGHICI – investigator - member
- Florin DOBRE – investigator - member
- Ștefan BĂTRĂNOIU – head of SC – CFR Marfa C-ta Branch - member
- Constantin OPREA – inspector SC-T – CFR Marfa C-ta Branch - member

A. BRIEF PRESENTATION OF THE ACCIDENT

A.1. Brief presentation

On the 30th of September 2010, the train no. 53598, circulating between Constanta Port Mol 5 and Fetesti, was towed to EA 533 and the pushing locomotive DA 1306 on the distance Constanta Port Mol 5 – Palas and on the distance Saligny Est – Fetesti was impaired as pushing locomotive the DA 60-1361-9. After passing through the railway station Ovidiu, at around 14:00, circulating on the current line wire I to Fetesti station, at km 153+000, a fire occurred at 14:08 in the engine box in the area of traction engines no. 4 and 5, on the right side of the running direction, and it expanded to the locomotive cabins.

Unable to locate and extinguish the fire, the driver used his personal phone to call 112, asking for the intervention of the Firefighters and the Inspectorate for Emergency Situations, who arrived at 14:20 at the fire place. Firemen intervention necessitated closing the current lines I and II and de-energizing their corresponding contact lines and the fire was extinguished at 15:43. The locomotive DA 60-1361-9 circulating as pushing locomotive for the train no. 53598 belongs to SNTFM – CFR Marfa – Constanta Branch – Palas Depot and it was driven by the locomotive driver and served by the driver assistant.

The accident place is at km. 153+000 on wire I current line between Ovidiu railway station and hm. Borcea Branch, line in embankment, alignment and gradient ramp to 10.8‰, in the running direction. Railway accident area is located on the circulation department Constanta - Bucharest, belonging to CNCF CFR SA, CF Constanta Regional Branch.

A.2. Causes of the accident

A.2.1. Direct cause

Occurrence of a fire due to lightning from the crossing area of supply conductors for electric traction engines no. 4 and 5, due to insufficient insulation, neoprene tube degradation, followed by ignition of combustible deposits accumulated for the operation of the locomotive and propagated to the power wiring of the electric traction motors no. 4, 5 and 6, which led to the development of a fire in the engine box and cabins.

Contributing factors

The emergence of self-inductance surge in electric traction motors switching that missing the deadline established under a specific type of repair work on the locomotive was due (due to repairs RG in August 2007), led to power cable insulation aging and to a thermo technical poor condition (loss of oil, diesel, gas) that favored the initiation and especially the propagation of the fire.

The inefficiency of the primary means of intervention, under violent fire propagation and failure by locomotive staff because of gas and smoke, combined with the intervention of specialized personnel in the Inspectorate for Emergency Situations, at about 93 minutes from approval.

A.2.2. Underlying causes

It wasn't followed the Provision D4.8/445/2004 of SNTFM CFR Marfa SA - Locomotive Repair Service on the works of prevention of the fire starts at diesel locomotives – electric 2100 CP, regarding the

protection of the power wiring of the electric traction engines and for cleaning oil deposits (fuel, lubricants) from the intersection area and the cables connection board from the engines 4, 5 and 6, where these can accumulate.

It wasn't complied the repair cycle and mandatory overhaul of the locomotive, according to the railway Norm "Railway vehicles. Overhauls and planned repairs" no. 67-005 of 2008 approved by OMT no. 364/2008, in that the planned overhauls of the locomotive were made based on actual days provided and not rendered by a cycle set by order.

A.2.3. Root causes

There were not identified root causes for this investigation.

A.3. Severity level of the accidents

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

The safety recommendations aim to solve the next issues:

1. Compliance with the OMT no.364/2008 for the mandatory overhauls cycles and planned repairs of engines railway vehicles.
2. Compliance with the provision D4.8/445/2004 of Locomotive Repair Service of SNTFM CFR Marfa SA on how to perform the works of prevention of the fire starts at diesel locomotives – electric 2100 CP.
3. Supplementing of regular technical checks of insulating capacity of cables and of protection solution provided by the provision D4.8/445/2004 for the locomotives with the repair term overdue and replacement of the cables with inappropriate characteristics.
4. Analysis by rail operators who hold this type of locomotive (LDE 2100 HP) of the opportunity to complete the technical equipment of the locomotive with a facility to provide, until the intervention of the specialized staff ISU, a fire mitigation, using the resource of about 1400 liters of water cooling system or other equipment to enable effective intervention of the locomotive staff in the presence of gas or smoke.

The addressees of the safety recommendations are: SNTFM CFR Marfa SA Bucharest and the Romanian Railway Safety Authority.

This investigation report will be sent to Romanian Railway Safety Authority, to SNTFM „CFR Marfa” SA and to the National Railway Company “CFR” SA.

B. INVESTIGATING REPORT

B.1. Description of the accident

On the 30th of September 2010, the train no. 53598 running between Saligny Est and Fetesti, hauled by the locomotive EA 533 and the pushing locomotive DA 1361 had command of crossing the railway station Ovidiu at 14:05 in the direction of hm. Borcea Branch.

After passing the station Ovidiu, at around 14:08, the driver and the driver assistant of the pushing locomotive noticed an emanation of smoke to the locomotive, outside the locomotive box, in the area between the two bogies to the end of the diesel tank on the right side in the running direction, next to the traction engines 4 and 5, for which they inform, through RTF station, the driver of the locomotive of the train head to take action of quick stop of the train.

Effects of the fire on the equipment in the engine box on the right side of the locomotive.



Effects of the fire on the equipment of command, indication and protection, in the cabins.

The driver took action of stop the locomotive at km 153+000, on the section I and II AD wire I Ovidiu - hm. Borcea Branch and together with the driver assistant tried to localize and to extinguish the fire with the fire extinguishers of locomotive equipment, calling at the same time the emergency service at 112.

The fire couldn't be extinguished by the locomotive staff with the existing resources.

There were no people injured.

Intervention plan of the emergency rescue services

At 14:20 arrived on the spot the Inspectorate for Emergency Situations. At 14:29 the Railway Energy Dispatch Fetesti de-energized the contact line corresponding to wire I and II from Ovidiu to hm. Borcea Branch and the lines 3 and 4 in railway station Ovidiu.

At 14:20 Fetesti traffic controller was required to allow the trolley pantograph belonging to SC Electrificare CFR SA, to travel to the scene. At 14:27 is given the circulation order to the trolley pantograph and at 14:29 it leaves the station Fetesti to station Ovidiu.

At 15:01 were installed and grounded the connectors to the contact line, enabling access to the fire place for the firemen intervention team, traffic on the lines I and II between the station Ovidiu and hm. Borcea Branch being closed.

Starting at 3:07 p.m. firefighters belonging to Fetesti Fire Station began extinguishing procedures, which was closed at 3:43 p.m.

DA 1361 locomotive condition at the accident place, after the fire extinguishment.

At 3:46 p.m. wires I and II were re-energized between Ovidiu station and hm Borcea Branch.

At 16:50 the help locomotive DHC 023 leaves isolated from Fetesti station as train no. 81501 and it arrives at Ovidiu station at 5:02 p.m.. At 6:14 p.m. DHC 023 leaves as train 33062, from hm Ovidiu, towing the locomotive DA 1361 to Fetesti station where it arrives at 6:29 p.m..

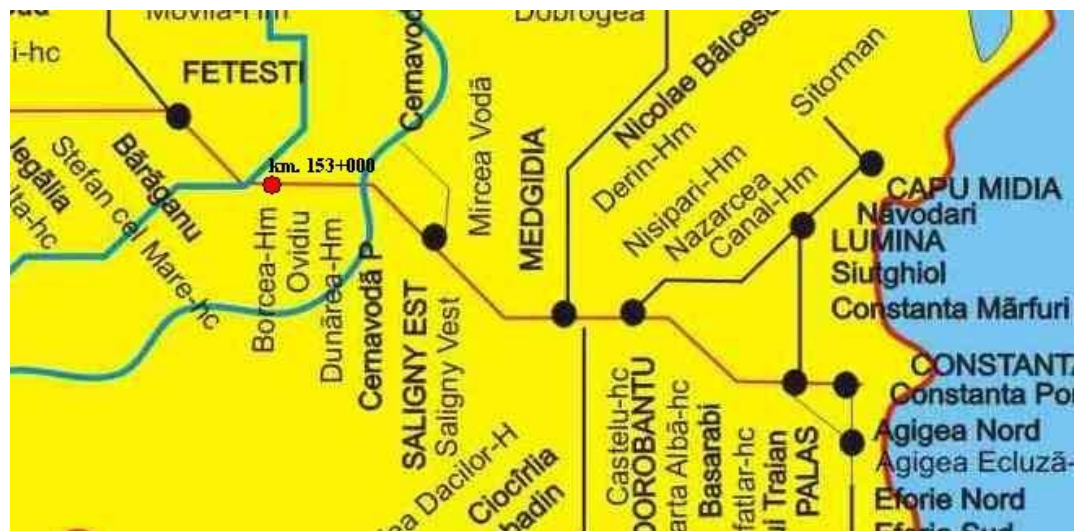
At 5:43 p.m. railway reopened to traffic wire I Ovidiu - hm Borcea Branch, after the withdrawal of the train no. 53 598 in Ovidiu station.

The accident place is located at km. 153 000, on wire I hm. Borcea Branch - Ovidiu, arranged in embankment, alignment and ramp with gradient of 10.8 % in the running direction.

The wires I and II between hm. Borcea Branch - Ovidiu are electrified and trains circulation is made by automatic line block system (BLA).



Geographical location of the accident



B.2. The accident circumstances

B.2.1. Involved parties

2.1.1 Involved staff belongs to SNTFM "C.F.R. Marfa" - SA, Constanta Branch, and Depot Palas - Fetesti Locomotives Shed.

2.1.2 Locomotive DA 60-1361 - 9 belongs to SNTFM "CFR Marfa" - S.A. and is maintained by IRLU Palas Division staff belonging to SC Locomotives and Equipment Maintenance and Repair CFR IRLU S.A. Bucharest.

2.1.3 The railway infrastructure in the accident belongs to CNCF "CFR" SA and is maintained by the staff of the Department Fetesti L3 - District 4 Cernavoda-Pod

2.1.4 Installations signaling, centralization and blocking (SCB) between Hm. Fetesti Borcea Branch and Ovidiu are managed by CNCF "CFR" SA - Regional Branch CF Constanta and are maintained by staff belonging to Section CT 2 Fetesti.

2.1.5 The installation of railway communications from Ovidiu station and hm. Borcea Branch is managed by CNCF "CFR" SA and is maintained by staff belonging to SC RAILWAY TELECOMMUNICATIONS CFR S.A.

2.1.6 The installation of power and electric traction (IFTE) is managed by CNCF "CFR" SA and is maintained by staff belonging to SC Electrification CFR.

2.1.7 The installation of railway communications on the involved locomotive is SNTFM "CFR Marfa" SA property and is maintained by staff belonging to Division IRLU Palas, belonging to SC Locomotives and Equipment Maintenance and Repair CFR IRLU S.A. Bucharest.

The investigation commission questioned the employees involved in the driving / service of the involved locomotive and took statements from the IDM in charge from Ovidiu station.

B.2.2. Forming and equipments of the train

The train no. 53598, consisted in 33 Uagps wagons loaded, with 2445 gt, 132 loaded axles, braked mass by book – automatic 1223, by hand 293 and as it is – automatic 1508, by hand 588 and the train length of 552m, towed by the locomotive EA 533 and pushing DA 1361, the driving team was fully ensured, consisting of driver and driver assistant.

The locomotive DA 1361 involved in the accident belongs to the rail operator SNTFM “CFR Marfa” SA, being in operation of Constanta Marfa Branch – Depot Palas.

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

B.2.3. Railway equipments

The involved railway infrastructure, running lines I and II between hm. Fetesti Borcea Branch – Ovidiu, is managed by CNCF “CFR” SA – Regional Branch CF Constanta and maintained by staff from Section L3 Fetesti – District 4 Cernavoda Pod.

Lines I and II between Ovidiu station and hm Borcea Branch, at km 153+000 are electrified, in embankment, in line and ramp with slope of 10,8‰ in the running direction, rail built type 60 E 1, on concrete sleepers W 60.

B.2.4. Communication means

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

B.3. Accident consequences

B.3.1. Death and injuries

None.

B.3.2. Material damages

After the fire, the damage and expenses incurred amounted to 45 958.23 lei, detailed as follows:

- at the locomotive, according to the estimate no. 14/2010 of the Section IRLU Palas, amounted to 45 451,59 lei;
- train delays, according to the estimate no. 832/1/135/2010 of SNTFC “CFR Calatori” SA, Railway Passenger County Constanta, amounted to 217,97 lei ;
- at the lines – none ;
- at the installations – none;
- at the environment – none;
- cost of technical assistance for de-energizing the LC wire I + II Fetesti – Ovidiu and Ovidiu L1-4, according to the estimate no. 2/8/2/1983/01.10.2010 of SC Electrification CFR SA, Constanta Electrification Center, with a value of 288.67 lei.

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

The current line wire I, between Ovidiu – hm. Borcea Branch was closed for the traffic on wire I between 14:32 and 17:43. Between 14:32 – 16:14 the circulation was closed on wire I between Ovidiu – Fetesti station. At 16:14 the circulation was opened on wire I between hm. Borcea Branch – Fetesti station. The current line wire I between Ovidiu – hm. Borcea Branch was reopened at 17:43, after the withdrawal of the train no. 53598 in Ovidiu station.

Trains delayed:

Following the occurrence of this accident a passenger train was delayed by 77 min.

B.4. External circumstances

On the 30th of September 2010, at the time of the accident (2:08 p.m.), the current lines I and II between hm Borcea Branch – Ovidiu were free.

On the 30th of September 2010, at the time of the railway accident, the visibility was good, clear sky, no wind and air temperature was about 25^o C.

The accident occurred in the area of the Km. 153 000, the line being in alignment, built with rail type 60 E 1, W 60 – type concrete sleepers, railway without joints, ramp with gradient of 10.8 ‰ in the running direction, double-track electrified.

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 railway staff statements

B.5.1.1. The summary of the of the railway undertaking staff and infrastructure manager statements

The driver of the locomotive DA 60-1361-9 on the 30th of September 2010 stated as follows:

- normal driving conditions between Medgidia and Ovidiu;
- after passing Ovidiu station, he noticed a smoke release in the engine box and he asked his assistant to determine the cause;
- the driver assistant told him that he noticed smoke and flame in the engine box, in the area of traction motors 4 and 5;
- he informed through RTF the driver of the trailer train EA 533 on the release of smoke and took immediate action to stop the train;
- after they noticed the beginning of the fire, they intervened in the area of traction motors 4 and 5 with the extinguishers from both work stations to locate and extinguish the fire;
- he used together with the driver assistant all the extinguishers of the locomotive equipment, trying to extinguish the fire;
- unable to extinguish the fire, he dropped together with the driver assistant near the locomotive, where the security service of the motorway A2 inform them that they had also announced the firemen about the fire occurred to the locomotive;
- he asked through RTF the driver from EA 533 to press the train in order to unravel the locomotive DA 1361 and thus to provide distance between the locomotive in fire and the rest of the train;
- then he secured the locomotive DA 1361 in place with the handbrake;
- firemen arrived on the scene around 2:20 p.m.;

The driver assistant of the locomotive DA 1361 hauling as pushing locomotive the train no. 53598 between Saligny Est – Ovidiu stated as follows:

- he served the locomotive DA 1361 on the route Medgidia – Saligny Est where it ran isolated as train no. 87938. At 1:30 p.m. the locomotive is attached as pushing to train no. 53598 and it runs without stopping to Ovidiu station;
- after overcoming the output signal of the station Ovidiu, he noticed a smoke release in the driving station (cabin II);
- he informed the driver about this and when he opened the engines box, the fire occurred in the area of traction motors 4 and 5;
- he took the extinguishers from cabin II and the driver brought the ones from cabin I, using so all the 4 extinguishers;

- while he was running next to the locomotive, the security of the motorway A2 informed him that they had called 112;
- he released the locomotive from the train, so that the driver could provide distance;
- he secured the locomotive with the handbrake and he waited for the firemen;
- Firefighters could not occur between 2:20 p.m. to 3:01 p.m., until they were mounted and grounded the connectors to the contact line.

The movements inspector on duty in hm. Ovidiu, on the 30th of September 2010, stated as follows:

- train no. 53598 had road crossing by station Ovidiu according to the notice received at 1:57 p.m., filled with the mention diesel pushing then he made the crossing command for the train no. 53598, with input in deviation and output on direct line wire I, to h.m. Borcea Branch;
- he came out of the office before the train no. 53598 pass the first switch for supervision by scrolling of the train and he didn't notice anything special, the train being flagged instructional;
- he sent notice of transition to IDM in h.m. Borcea Branch, respectively Fetesti Station;
- he noticed on the display that the train had slowed, then he asked the driver about the brake and he was told that there was a strong smoke release at the pushing locomotive;
- then he informed the circulation operator and the station manager;

The driver of the locomotive EA 533 towing the train no. 53598 as holder locomotive, on the 30th of September 2010, stated as follows:

- he is employed by Marfa Galati Branch – Buzau Depot and the locomotive belongs to Targu Mures Depot
- he was advised with EA 533 from Palas Depot to haul the train no. 53598 between Constanta Port Mol 5 – Fetesti;
- at 12:25 he stopped in Saligny Est station to attach to the train the pushing locomotive DA 1361;
- after the continuity test in Saligny Est station, at 13:35 the train was sent to Fetesti station;
- between Saligny Est – Ovidiu the train ran on wire II;
- he was announced through RTF station by the IDM on duty that the train had input from wire II in deviation on wire I to h.m. Borcea Branch;
- he notes that all the way the train ran under normal conditions following the train through mirrors, including the train passing by Ovidiu;
- after the train left Ovidiu station, at km. 152+700 he was announced through RTF by the driver of the pushing locomotive DA 1361 to take action for fast braking the train because a smoke release had been found to the locomotive DA 1361;
- after the train stopped, at 2:10 p.m., he pressed the train to detach the locomotive DA 1361 from the train;
- after the locomotive DA 1361 was unraveled, he detached the train at 14:20 from km 152+700 to 152+500 where it stopped at 14:30 ;
- after stopping the train he secured the train with the auto brake, the direct brake and the handbrake of the locomotive;
- he considered he had to make distance because he had been announced through RTF station by the IDM from Ovidiu station that a fire occurred to DA 1361. He disconnected the locomotive and he lowered the pantograph because the firemen intervention had been asked and the contact line was going to be removed from the supply;

The driver assistant who served the locomotive EA 533 that was hauling the train no. 53598 on the 30th of September 2010, stated as follows:

- is employed by Marfa Galati Branch – Buzau Depot

- he served the locomotive EA 533 that was hauling the train no. 53598 from 10:10 from Palas station to Saligny Est station, where at 12:25 the train was stopped in order to be attached the pushing locomotive DA 1361;
- after the pushing locomotive attachment and the continuity test, the train was sent at 13:35 from Saligny Est station to Fetesti;
- between Saligny Est – Ovidiu the train ran on wire II, then the driver was announced by the IDM of Ovidiu station that the train had command of input from wire II in deviation to wire I – Borcea Branch;
- on this distance the train ran in normal conditions;
- following the train through the mirrors, the train had no problems to pass through the station Ovidiu;
- after leaving the station Ovidiu, at km. 152+700, we were announced through RTF by the driver of the pushing locomotive DA 1361 to take actions of fast braking the train, because a smoke release had been noticed to DA 1361;
- after stopping the train at km. 152+700 at 2:10 p.m. the driver pressed the train to detach from it the locomotive DA 1361 where the beginning of a fire had been found;
- after unraveling the pushing locomotive they tried to detach the train at 2:20 p.m. from the km. 152+700 to km 152+500 at 2:30 p.m.;
- after stopping the train we took actions to maintain the train in place, squeezing the 2 brakes of the locomotive EA 533, as the driver asked;
- according to the clinch from the brake note he went on site to identify and tighten the handbrakes of the wagons in order to keep the train in place.

B.5.2. Safety management system

The infrastructure manager CNCF “CFR” SA and the rail operator SNTFM “CFR MARFA” 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 soon after the railway accident by the members of the investigation commission;
- rail norm “Railway vehicles. Overhauls and planned repairs” no. 67-005 of 2008 approved by OMT no. 364/2008;
- provision D4.8/445/2004 of Locomotive Repair Service of SNTFM “CFR Marfa” SA
- statements of the teams on the locomotives and of the IDM on duty from Ovidiu station;
- the report prepared by the members of the investigation commission after 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;
- documents of release of the train

B.5.4. Work of the rolling stock

B.5.4.1. Data found on the locomotive DA- 60-1361-9:

B.5.4.1.1. Data resulted from the checks carried out on the 6th of October 2010 by the investigation commission and the maintenance and repair staff of the Department IRLU Palas and recorded in the minutes (piece of the investigation file) and photos (made 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 and 5 had the supply wiring thermally affected.

Inside, there was no sign of short circuit, flashover of insulators or insulation penetrations;



The electric traction engines no. 1, 2, 3, 6, technically appropriate, without thermal damage and provided only at the bottom with neoprene protection tubes.

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



- auxiliary tank and associated piping were intact and free from recent intervention and without thermal damage;
- main tank without thermal damage, was sealed and without traces of recent intervention;
- the electric engine for forced ventilation of the bogie no. 2, without traces of short-circuit, with the insulation and the inside wiring thermally damaged due to the external fire and without friction between turbines - housing



- wiring of series marking and power of the traction engines no. 4 and 5, had burned insulation between doses fixing slippers and clamps for fixing at the entry into the cable channel
- there were no traces of short circuit, cuts in slippers areas at all the power cables.

Relays condition

- maximal power relays pos. 53 were sealed without being in action;
- protection relays against making mass pos. 32 were sealed;
- the compressor, the main generator and the transfer pump were removed and checked and there were not found fire generating causes;
- in the area of the diesel engine cooling radiators on the right, the paint is thermal damaged due to the combustion of the gaskets at the support frame;

Condition of the accumulators

- the set of accumulators and the inside of the niches, the insulation of the flexible marking connections between the boxes didn't have traces of short circuit or thermal damage;

The condition of the electrical cables corresponding to the electric traction engines after the fire

From measurements made with the megohmmeter on a scale of 1000V, at the portions of cable not thermal damaged, there were found following:

- series marking cables of the traction engine **no. 1**, 4 pieces, insulation resistance value measured was 90 G ohms;
- series marking cables of the traction engine **no.2**, 4 pieces, insulation resistance value measured was 96 G ohms;
- series marking cables of the traction engine **no.3**, 4 pieces, insulation resistance value measured was 1 G ohms;
- series marking cables of the traction engine **no.4**, 4 pieces, insulation resistance value measured was 100 M ohms;
- series marking cables of the traction engine **no. 5**, 4 pieces, insulation resistance value measured was 100 G ohms;
- series marking cables of the traction engine **no.6**, 4 pieces, insulation resistance value measured was 1 G ohms;

The condition of power cables from the output of the channel to the log dose of the traction engines no. 4-6 after the fire.



B.5.4.1.2. Data resulted from the documents asked from the rail operator

- the last repair type RR was made on the 15th of August 2002 at SC RELOC SA Craiova according to the minutes on the 12th of August 2002;
- the deadline for the locomotive DA 1361 RG repair was August 2010;
- the last inspection type “RT” was made on the 28th of June 2010 at the Locomotive Repair Section Palas Constanta. Prior to this overhaul, the locomotive made another RT type inspection on the 24th of March 2010 against OMT 364-2008, table 3.1.
- the last inspection type PTAE was made at IRLU Palas Section, on the 26th of September 2010;
- according to the sheet board of the locomotive DA 1361, it wasn’t reviewed at the exit from Medgidia Depot belonging to RTFC Constanta on the 26th of September 2010.

B.6. Analysis and conclusions

B.6.1. Analysis of the fire occurrence

The fire was started in the crossing area of the series marking cables of the electric traction engines 4 and 5, the first observation of the smoke release followed by fire was between the fan of the engines 4-6 and the end of the diesel engine.

First the fire was maintained by residual accumulations of petroleum products available on cable insulation, outside the bellows between the fan and motor housing.

The overheating caused ignition of the wiring insulation at the traction engine no. 4, then of the other power cables of the two traction engines 4 and 5.

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

Metal parts of the Diesel Engine – Generator group with damaged paint, but without distortions or major degradation of the structural resistance.

The traction engines, the electric machines for the auxiliary services, the supply and control cables checked at the dismantling made in Fetesti depot, according to the minutes no. TF8/2575/06.10.2010 didn’t show traces of short circuit, cuts or local melting to initiate the fire.

There were checked by dismantling the turbines and the housing of the forced ventilation of the electric traction engines on the bogie no. 2 and no traces of friction generating sparks were found.

Subsequent propagation of the fire was made by successive ignition of the wiring insulation, sealing and connecting rubber elements in the engines box.

Burning was maintained also by the combustible deposits under the floor of the engines box and the driving cabins, and by the oil from the hydrostatic installation.

Further the fire continued mainly by burning fuel elements (wiring insulation, flooring, upholstery, etc) inside the driving cabins and its exterior at station II.

B.7. The accident causes

B.7.1. Direct cause

Producing a fire due to lightning in the crossing area of the supply conductors for the electric traction engines no. 4 and 5, due to an insufficient insulation, neoprene tube degradation, followed by the ignition of combustible deposits accumulated for the operation of the locomotive and propagated to the supply wiring of the electric traction engines no. 4, 5 and 6, which led to the development of the fire in the engines box and the driving cabins.

Contributing factors

The emergence of self-inductance over-voltages when switching the electric traction engines that missing the deadline established under a specific type of repairs that the locomotive was due (due to repairs type RG in August 2007), led to the aging of power wiring insulation and to a thermo-technical poor condition (loss of oil, diesel, gas) that favored the initiation and especially the propagation of the fire.

The inefficiency of the primary means of intervention, under violent fire propagation and failure on action of the locomotive staff because of the gas and smoke, combined with the intervention of specialized staff in the Inspectorate for Emergency Situations, at about 93 minutes from the notice.

B.7.2. Underlying causes

It wasn't complied the Provision D4.8/445/2004 of SNTFM CFR MARFA SA – Locomotive Repair Service on the works of fire beginning prevention at the electric diesel locomotive 2100 CP, on protecting the power wiring of the electric traction engines, and for cleaning the deposits of petroleum products (fuel, lubricants) in the area of intersection and wiring connection board for the engines no. 4, 5 and 6, where they can accumulate.

It wasn't complied the cycle of repairs and mandatory overhauls of the locomotive, according to the railway Norm "Railway vehicles. Overhauls and planned repairs" no. 67-005 of 2008 approved by OMT no. 364/2008, in that the planned overhauls of the locomotive were made based on actual days provided and not rendered by a cycle set by order.

B.7.3. Root cause

None.

A.4 Safety recommendations

The safety recommendations aim to solve the next issues:

1. Compliance with the OMT no. 364/2008 regarding the mandatory cycles of overhauls and planned repairs to the engine railway vehicles.
2. Compliance with the provision D4.8/445/2004 of the Locomotive Repair Service from SNTFM CFR MARFA SA on how to execute the works of the beginnings of fire prevention at the electric diesel locomotives 2100 CP.
3. Additional actions of regular technical check the insulation capacity of the wires and of the protection solution available by the provision D4.8/445/2004 for the locomotives with the repair term overdue and the replacement of the wires with inappropriate characteristics.
4. Analysis by rail operators who hold this type of locomotive (LDE 2100 HP) the opportunity to complete the technical equipment of the locomotive with a facility to ensure, until the intervention of the specialized staff ISU, a fire mitigation, using the resource of about 1400 liters of water from the cooling system or other equipment to enable effective intervention to locomotive staff in the presence of gas or smoke.

The addressees of the safety recommendations are: SNTFM “CFR Marfa” SA and the Romanian Railway Safety Authority.

This investigation report will be sent to Romanian Railway Safety Authority, to SNTFM „CFR Marfa” SA, to CNCF “CFR” SA and SC Locomotives and Equipment maintenance and Repair “IRLU CFR” SA Bucharest.

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:

- Cristian BOBE – main investigator _____
- Marian DRĂGHICI – member _____
- Florin DOBRE - member _____
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- Constantin OPREA - member _____