



REPUBLIK OF BULGARIA
MINISTRY OF TRANSPORT, INFORMATION
TECHNOLOGY AND COMMUNICATIONS

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FINAL REPORT

on

**Technical Investigation of Railway Transport Accident -
fire outburst in electric locomotive No 44081.8 while servicing fast train
No 8626 at a time of movement between Aytos - Chernograd stations on
railroad No 2 on April 13th, 2016**



July, 2016

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movement between Aytos – Chernograd stations on railroad No 2 on April 13th, 2016***

Purpose of the Report and level of responsibility

In accordance with Directive 2004/49/EC of the European Parliament and the European Council on the safety of railway transport in the Community, the Railway Transport Act (RTA) of the Republic of Bulgaria and Ordinance No 59 dd. 5.12.2006 on the safety management in railway transport, the investigation of railway accidents aims to establish the causes having led to the realization of accidents, in view of their elimination and prevention in the future, **without searching for anybody’s guilt or responsibility**.

The investigation is carried out on the grounds of Art. 115i, par. 2 of the Railway Transport Act, Art. 78, par. 1 of Ordinance No 59 dd. 5.12.2006, and Order No ПД-08-212/22.04.2016 of the Ministry of Transport, Information Technologies and Communication. In that respect, Commission on investigation of the railway accident has been duly appointed.

The Investigation Commission has performed several examinations of the burned-off locomotive and inquired the persons having direct relation with the accident. For fast clarification and establishment of circumstances and causes having led to the occurrence of the accident external experts were also included in the Technical Investigation Commission. During the investigation analyses were carried out of the report, the protocols of findings and the documents provided by the Operative Group, as well as of other additionally requested materials. In the presence of the Commission from the Ministry of Transport, Information Technologies and Communication material evidence was taken away by the experts of the “Center for Investigations and Expertise” of the Fire Safety and Protection of Population General Directorate at the Ministry of Interior, on the basis of which a complex fire-technical and electric-technical expertise was elaborated. In parallel, the submitted opinions of the appointed external experts in fulfillment of their entrusted tasks were discussed and accepted by the Chairman of the Commission.

1. Facts and circumstances established in the course of investigation

On 13.04.2016 fast train No 8626, composed of 6 passenger wagons (2 coaches, 3 second-class wagons and 1 first-class wagon) and electric locomotive No 44151.9 in front of them in non-operational (cold) condition, was serviced by electric locomotive No 44081.8. The train was operated from the II-nd cabin of locomotive No 44081.8 by a locomotive brigade including locomotive engine driver and assistant engine driver, and locomotive No 45151.9 was accompanied by a locomotive engine driver. All of them are employees of Sofia Locomotive Depot at BDZ Passenger Services Ltd. The transportation brigade having serviced the train included the head of train, a guard and two guards of coaches, all of them from the “Territorial Center for Passenger’s Transports” – Sofia. Train No 8626 is with transport route Burgas – Yambol – Plovdiv – Sofia in accordance with the trains’ traffic schedule.

The train departed from the station of Burgas at 10:15 p.m., according to the schedule, observing the traffic speeds and the arrival and departure times. Upon traveling in the section to Aytos station, the train moved without any reported deviations from the train’s traffic schedule, except for one extra stop at Druzhba station where the train servicing brigades obtained Model Form II-A (for departure from Druzhba station upon closed exit signal).

At Aytos station the locomotive engine driver left the locomotive and, after passing along the platform near the locomotive, entered the 1-st cabin, in order to check the registering speedometer’s tape records. Upon passing alongside of the locomotive, the locomotive engine driver examined visually the mechanics of the locomotive’s traverse gear for failures, did not observe any fire, and did not feel any specific smell (as evidenced by the explanation).

The train departed from Aytos station at 11:02 p.m., reaching speed of up to 99 km/h, with which it moved for 4400 meters, after that the speed gradually dropped down to 40 km/h, and with such a speed the train passed other 190 meters, after that the speed increased gradually to 59 km/h for one peak, after that dropped gradually to 50 km/h and at 11:06 p.m. after a fast stop the speed dropped down to 0 km/h, as evidenced from the executed decoding of the speedometer tape at Sofia Locomotive Depot. At Aytos station the engine drivers did not feel any smell of insulation material.

During movement in the inter-station section Aytos – Chernograd on railroad No 2 at km 254⁺⁰⁰⁰ (before Karageorgievo train stop), the locomotive brigade felt the smell of burned insulation material. The crew members switched on the lighting in the locomotive's cabin and in the machine compartment to investigate the place of such burning smell's origin (as evidenced by the submitted written explanations). From the executed internal inspection of the locomotive the crew did not manage to establish the place of the smell's origin, so the crew undertook an external examination of the locomotive through the side windows. Thereupon the locomotive engine driver noticed on the right side of the locomotive fire in the middle under the locomotive's body, in the area of the cooling fans. The locomotive engine driver communicated an audible signal for fire alarm with the locomotive horn and undertook an overview of the region for the selection of an appropriate location to stop the train, in order to ensure more convenient access to the train. After stopping the train, the locomotive brigade tried to disconnect the locomotive from the train's composition. Though, after selection of 2-nd position for pressing of the locomotive to the train's composition, the main air breaker switched off and the locomotive remained connected to the train.

After the unsuccessful attempt to disconnect the burning locomotive from the train's composition, the locomotive engine driver switched off the automatic protector No 832 of the accumulator batteries, held on the automatic train break and fastened the manual break of the locomotive, to ensure the train against uncontrolled self-movement.

Immediately after stopping the train, the locomotive engine driver left the locomotive in order to inspect the area of the under-body horizontal fans and the accumulator batteries' cabin, where he evidenced a fire outburst. Upon the inspection the locomotive engine driver evidenced strong flames exiting from the under-body horizontal engine fans and immediately activated the fire extinguishing installation of the locomotive from the first command cabin. Thereafter, with the support of the assistant engine driver, the locomotive engine driver took down the portable fire extinguishers of the locomotive and started fire extinguishing. Thereupon the locomotive engine driver acted on the right side and the assistant locomotive engine driver acted on the left side of the locomotive.

The locomotive engine driver accompanying the damaged locomotive No 44151.9, after having heard the emitted audible fire alarm signal, immediately looked through the right window of the locomotive and saw fire emitting in the middle of locomotive No 44081.8. After stopping of the train, the locomotive engine driver of locomotive No 44151.9 dropped down from the left side and together with the assistant locomotive engine driver tried to disconnect the burning locomotive from the train's composition, but did not succeed.

At the same time the head of train together with the train guards organized the passengers' evacuation from the train at a safe place and communicated information on telephone 112 about the fire outburst. After the evacuation of all passengers the train guards took the available fire extinguishers from the wagons, in order to assist the locomotive brigade in the fire extinguishing. The locomotive engine driver of locomotive No 44151.9 tried to bring down the portable fire extinguishers from the locomotive but when he saw that the train's guards had brought fire extinguishers from the wagons, took these from the guards and started to fight the fire from the left side of the locomotive.

The first firefighting car arrived at the place of accident around 11:25 p.m. and undertook locomotive's extinguishing. After about 15-20 minutes there also arrived a second fire fighting car, with the help of which the fire was visibly almost extinguished. In this moment the two firefighting cars finished their water and departed from the place to tank some additional water. This enabled the fire to outburst anew in full force, as a result of which almost the entire

equipment of the locomotive was destroyed, thereafter the catenary was burned and dropped down on the railway line. The two firefighting cars returned back and re-started firefighting. The locomotive was finally extinguished at about 02:10 a.m. After extinguishing of the fire, the composition of train No 8626 was guarded by firemen on duty till its transportation away from the inter-station section.

Diesel locomotive No 55137 was sent from Karnobat station to draw the composition of fast train No 8626 to Aytos station, but as a result of burning off of the contact conductor line and its falling down over the wagons and the railway line, the locomotive did not succeed to reach the composition and returned back to Aytos station.

For lifting of the catenary at an overall distance at electricity distribution sub-region Karnobat, in 02:32 a.m. an emergency team was sent, equipped with a rail self-propelled specialized machine CM-03. After completion of the work of the emergency team with machine CM-03 at the inter-station section, at 06:27 a.m. the team returned back to Aytos station and reported that the overall dimension for trafficking was provided.

For servicing of passengers from fast train No 8626 to their final destination, BDZ Passenger Services Ltd. provided 2 buses, which transported the passengers found at the level crossing near Karageorgievo train stop.

At 07:36 a.m. diesel locomotive No 55137 departed from Aytos station for a second time to draw the composition of fast train No 8626 and at 08:36 a.m. the composition arrived at Aytos station. After that locomotive No 55137 departed again for the inter-station section to pull the burned-off locomotive No 44081.8, which was parked at Aytos station at 10:02 a.m.

Train's trafficking at the inter-station section Aytos – Chernograd on railroad No 2 was suspended from 11:02 p.m. on 13.04.2016 till 07:03 p.m. on 16.04.2016.

2. Officials involved in the case.

2.1 Locomotive crew:

2.1.1. 'Locomotive Engine Driver' of electric locomotive No 44081.8 from Locomotive Depot Sofia at BDZ Passenger Services Ltd. – 6 years of service;

2.1.2. 'Assistant Locomotive Engine Driver' of electric locomotive No 4081.8 from Locomotive depot Sofia at BDZ Passenger Services Ltd. – 1 year of service;

2.1.3. 'Locomotive Engine Driver' of electric locomotive No 44151.9 from Locomotive depot Sofia at BDZ Passenger Services Ltd. – 3 years of service;

2.2. Train crew:

2.2.1. 'Head of Train' from Territorial Passenger Transport Centre Sofia at BDZ Passenger Services Ltd. – 6 years and 5 months of service;

2.2.2. 'Train Guard' from Territorial Passenger Transport Centre Sofia at BDZ Passenger Services Ltd. – 2 months of service;

2.2.3. 'Coach Guard' from Territorial Passenger Transport Centre Sofia at BDZ Passenger Services Ltd. – 15 years and 11 months of service.

2.2.4. 'Guard' from Territorial Passenger Transport Centre Sofia at BDZ Passenger Services Ltd. – 2 years and 4 months of service.

2.3. Station staff:

2.3.1. 'Traffic Manager' – Aytos Railway Station – an employee at Management of Train Movement and Railway Station Operation Office – Plovdiv, the National Railway Infrastructure Company – 14 years of service;

2.3.2. 'Traffic Manager' – Bulgarovo station – an employee at Management of Train Movement and Railway Station Operation Office – Plovdiv, the National Railway Infrastructure Company – 10 years of service;

2.3.3. 'Traffic Manager' – Chernograd station - an employee at Management of Train Movement and Railway Station Operation Office – Plovdiv, the National Railway Infrastructure Company – 20 years of service;

2.3.4. 'Post Switchman' – Aytos Railway Station – an employee at Management of Train Movement and Railway Station Operation Office – Plovdiv, the National Railway Infrastructure Company – 26 years of service;

3. Physical condition of the officials involved in the accident.

Officials having to do with the accident were given a rest period of required duration before starting work, according to the Labour Code and Ordinance No 50 dd. 28.12. 2001 on the working time of managerial and general staff engaged in the provision of services of carriage for passengers and freight in the railway sector.

Officials having to do with the accident were given a (pre-shift) briefing. They declared that they were alert and relaxed, and that they had not used alcohol and other intoxicating substances.

Officials related to the accident have valid psychological testing certificates.

4. Certificates of qualification and holding a position

The officials from the National Railway Infrastructure Company related with the accident hold the required certificates of professional capability and qualification.

The locomotive staff of locomotive No 44081.8 from BDZ Passenger services Ltd. hold the required certificates of qualification, as well as the professional qualification to operate the particular series of locomotives.

5. Actions performed by officials before and during the accident

Immediately before and during the accident the officials from the National Railway Infrastructure Company have acted in conformity with the established normative regulations and internal rules regulating safety of carriage by rail.

During the accident the officials from BDZ Passenger Services Ltd. (the locomotive crew) were not present at the exact spot of fire outburst, neither did they act in accordance with Art. 8, par. 1, item 7 of Safety Procedure 2.03 of the National Railway Infrastructure Company, by which they have caused a delay in hauling the wagons and the burned locomotive to Aytos station. They did not provide an accurate and complete information on the condition of the catenary (which at the time was dropped down on the rail track and over the rolling stock), and this necessitated returning back of the diesel locomotive to Aytos station, so that rail self-propelled specialised machine could be sent from Karnobat station to recover the catenary gauge.

6. Circumstances preceding the accident with respect to the railroad, signalling equipment, catenary, rolling stock and others

Meteorological data on weather, related to visibility of signals: at night time, air temperature: 10 – 11°C, south western wind with a speed of 3 m/sec, no clouds.

Railroad: in good operative condition, of no relation to the admitted railway accident.

Signalling equipment of the stations and the inter-station section and its status before the accident: the inter-station section is equipped with automatic blocking system and the stations - with route relay centralisation system of MPLI-H68 type, which is switched off and operations are done by phone manner (because of on-going modernisation and rehabilitation of the railway infrastructure under Operational Programme 'Transport'), the circumstance being of no connection with the relevant railway accident.

Catenary: in good operative condition, not related to the railway accident.

Marshalling depot: Burgas.

Communication equipment and telecommunication connections: in good operative condition.

Railway track profile, geometry and condition: the train stopped in the inter-station section between Aytos and Chernograd on road No 2, at km 254+000 in a straight section that is going downhill at an inclination of 10 0/00.

Rolling stock:

Electric locomotive No 44081.8, servicing fast train No 8626, was in good operative condition, including undercarriage, brake system, light and audible signalling equipment in accordance with the technical standards and requirements, which can be seen from the records in the relevant log books, copies of which are provided in the operative group's report.

Wagons: 6 wagons, of which 3 of B4 type, 1 of type A4, 2 of type WL4 and locomotive No 44151.9 (in a non-operational condition). The total number of train's axles: 28.

7. Observance of the procedures and technology of work in the system of the National Railway Infrastructure Company before and during the accident

The procedures and technology of work at Subdivision ‘Management of Train Movement and Railway Station Operation’– Plovdiv, which is part of the structure of the National Railway Infrastructure Company, were observed before and during the accident, as can be seen from the operative group’s report and its annexes, the additionally requested materials and the direct inquiries of persons related with the accident, performed by the Investigation Commission.

8. Observance of the procedures and technology of servicing the rolling stock in the carrier’s system before and during the accident

Fast train No 8626 was provided with the necessary brake mass and disposed of the requested train documents. The locomotive and the transportation crews were provided with business mobile phones.

Electric locomotive No 44081.8 is manufactured in 1979 and is included in the fleet of ‘Nikola Kolarov’ locomotive depot, Sofia.

The electric locomotive net book value on 13.04.2016 is BGN 1.273.941, 68.

At the time of accident the mileage of the locomotive after the last planned repairs are shown in the table below:

TYPE OF REPAIR	DATE OF LEAVING THE DEPOT AFTER REPAIR	MILEAGE AFTER REPAIR
General overhaul	16.04.1997	2 080 524 km
Medium scale repair	24.08.2007	959 556 km
Repair with elevating equipment	16.12.2014	195 097 km
Large-scale periodic repair	-	-
Small-scale periodic repair	30.11.2015	43 228 km
Technical check-ups	21.03.2016	11 356 km
Train operation inspection	12.04.2016	-

Upon the review of the technical documentation it was found that in conformity with IIII_IJIC 100/11, “Prescription on mileage run between repairs and cycles of planned inspections and repairs of electric locomotives and multiple-unit sets of BDZ Passenger Services Ltd.” Ordinance, as from the general overhaul performed on 16.04.1997 till the accident all inspections and repairs were carried out in conformity with the confirmed repair cycle.

Upon the inspection of the Technical Passport of locomotive No 44081.8” (LR 005-1) and the log book of the necessitated repairs of traction rolling stock (Form LP - 9), there were not found and registered any deviations from the applicable regulations on plant and depot repairs and maintenance of electric locomotives of the organisation, as well as from the repair activity procedures related with the fire outburst.

9. Status of the railway infrastructure and rolling stock before, during and after the accident

It was found that the railway infrastructure was in the proper operating condition before, during and after the accident.

Before the accident electric locomotive No 44081.8 and the wagons of fast train No 8626 were in the proper operating condition.

As a result of the accident, numerous damages on the electric locomotive are established, as specified in item 10, Consequences of accident.

9.1. Railroad switches

The accident was realized at the inter-station section and the railroad switches have no relation therewith.

9.2. Safety equipment

Automatic interlock system with axis' counters – switched off.

9.3. Rolling stock

Before the accident, there were not any detected faults in electric locomotive No 44081.8; as a result of the accident the locomotive was almost completely destroyed by fire.

Before the accident the wagons of train No 8626 were in good operating condition, and the accident has not caused any damages thereupon.

10. Consequences of the accident;

10.1. Death cases – none;

10.2. Injuries to persons – none;

10.3. Damages and losses caused to the tractive rolling stock: Electric locomotive No 44081.8 is a property of Locomotive Depot Sofia at BDZ Passenger Services Ltd.

Upon the locomotive's inspection the Investigation Commission found that the locomotive was completely destroyed by the fire.

The net book value of locomotive No 44081.08 at the time of the accident - 13.04.2016, was BGN 1.273.941, 68.

10.4. Damages and losses caused to the railway infrastructure:

10.4.1. Railroad and facilities:

- two rails, 12 m either, of 60 E 1 type;
- seven sleepers equipped with clamps and sleeper joists;

The expenditures on the railroad recovery by GCF – SK – 13 TRACE RAILINFRA CONSORTIUM amount to BGN 30.395,03, without VAT.

10.4.2. Safety equipment and communication, radio communications and electric supply:
none

10.4.3. Catenary:

- contact conductor 100 mm² – 300 m;
- bronze carrier cable 70 mm² – 300 m;
- cords and cord clamps of the Kruh type for 300 m;
- longitudinal power connector – 2 pieces;
- air gap without sectioning for recovery and regulation unit – 1;
- disarranged compensated anchorage of chain network on concrete anchor pole with stretchers – 3 pieces;
- single console – 1
- Disarranged catenary in two neighbouring fields – 2 000 m;
- Spring cords – 6 pieces;

The expenditures for recovery of the catenary by GCF – SK – 13 TRACE RAILINFRA CONSORTIUM amount to BGN39.155,66, without VAT.

The expenditures of Regional Subdivision 'Energy Section Plovdiv' at the National Railway Infrastructure Company for the safety provision of the catenary and providing gauge as a result of burning of locomotive No 44081.9 of train No 8626 on 13/14 April amount to BGN 2.279,76.

10.4.4. Other damages and losses:

Losses suffered by BDZ Passenger Services Ltd., Territorial Passenger Transport Centre Sofia, from overtime work done by the transportation crew having serviced train No 8626 on 13/14.04.2016 amount to BGN 89,17, without VAT.

10.5 Damages to wagons:

Passenger wagons No 50522974092.1, No 51522974142.4, No 51521974002.2, No 51522974087.1, No 61527071029.1 and No 61527071013.5 – in faultless condition, without any damages.

10.6. Interruption of traffic:

As a result of burning of locomotive No 44081.8 from the train composition of fast train No 8626, the traffic along Aytos – Chernograd section was interrupted on road No 2 from 11:02 p.m. on 13.04.2016 till 07:03 p.m. on 16.04.2016 (for recovery of the railroad infrastructure).

10.7. Delayed trains: 10.7.1. *Delayed trains*

- train No 30151, carrier BDZ Passenger services Ltd. + 75 min;
- train No 30153, carrier BDZ Passenger services Ltd. + 185 min;
- train No 2637, carrier BDZ Passenger services Ltd. + 52 min;
- train No 30194, carrier BDZ Passenger services Ltd. + 45 min;
- train No 30155, carrier BDZ Passenger services Ltd. + 40 min;
- train No 80121, carrier BDZ Passenger services Ltd. + 48 min;
- train No 28201, carrier BDZ Freight services Ltd.+ 11 min;
- train No 30522, carrier BDZ Freight services Ltd.+ 50 min;
- train No 30603, carrier BDZ Freight services Ltd.+ 165 min;
- train No 30587, carrier Bulgarian Railway Company AD (BRC) + 15 min;
- train No 80681, carrier BRC AD + 12 min;

10.7.2. *Cancelled trains*

- train No 8626, carrier BDZ Passenger services Ltd. – in the Aytos – Sofia section;
- train No 3637, carrier BDZ Passenger services Ltd. – in the Karnobat – Varna section;
- train No 30153, carrier BDZ Passenger services Ltd. – in the Sindel Marchalling Yard – Varna section;
- train No 30194, carrier BDZ Passenger services Ltd. – in the Varna – Sindel Marshalling Yard section;
- train No 80621, carrier BDZ Freight services Ltd.– in the Karnobat – Burgas section;
- train No 30651, carrier BDZ Freight services Ltd.– in the Karnobat – Varna Freight Park section;
- train No 90570, carrier Bulmarket Rail Cargp EOOD – in the Druzhba – Ruse North section;

10.7.3. Assigned trains:

- train No 30693, carrier BDZ – Freight Transport EOOD;
- train No 90590, carrier Bulmarket Rail Cargo EOOD;
- train No 89999, carrier BDZ Passenger services Ltd.;

10.7.4. Expenditures incurred from change of traffic schedule

The damages caused and the expenditures incurred by the National Railway Infrastructure Company by interruption of traffic at Aytos – Chernograd section on road No 2, resulting from the fire outburst in locomotive No 44081.8, servicing train No 8626 on 13/14.04.2016, amount to BGN 2.276,88. Total damages caused to the railway infrastructure and the railway rolling stock amount to BGN 1.248.138,18.

10.8. Movement of restoration means

10.8.1. Restoration train: none

10.8.2. Other means of restoration: none.

11. Causes of the accident

The main cause for the occurrence of the accident is the unsatisfactory condition of the electrical equipment of electric locomotive No 44081.8. An aggravating circumstance for the investigation is the established fact that the locomotive burned nearly completely. However, the inspection carried out by the Investigation Commission in Locomotive Depot Plovdiv established signs providing information about the reasons which brought to its burning down. The most likely reason for the fire is the mechanical destruction of some of the capacitors of the R – C groups of internal overvoltage suppression in the traction rectifier of the first traction group resulting from high temperature and exhausted resource. On touching the heated components of the rectifier cabinet (resistance, capacitors, conductors) the liquid dispersed from the capacitors caught fire and caused the burning process. This was confirmed by the condition of diodes in the rectifier cabinet of the first traction group – their copper conductors are fragile and brittle, which is a sign of reaching temperatures in the range of over 900°C. The diodes from the rectifier cabinet of the second traction group are heavily burnt too, but their conductors are flexible, which leads to the conclusion that the temperature was lower there, i.e. the highest temperature was developed in the rectifier cabinet of the first traction group, where the outbreak of fire occurred. The outburst

of the fire was favoured by the operation of the horizontal fan for cooling of the rectifier cabinet, which caught it into the ventilation duct. According to the locomotive crew's explanations, they did not switch off the fans even when the locomotive did not operate in traction mode, which caused the fire to burn up. It should be taken into consideration that the fan in question does not cool only the rectifier cabinet, but also the oil cooling radiator in the traction transformer, which is nearly always covered in dust and oil deposits. Reaching it, the open fire makes them burn very easily, thus making the fire more intensive. The strong air stream of the fan acted like a catalyser for the fast expansion of the fire. This is also supported by the testimony of the locomotive engine drivers who compared the flames coming out of the fan opening to those of a burner. As a result of the high temperature, the rubber joint of the engine pump for oil circulation in the traction transformer burned through, which caused spraying of oil in the engine room, and this was the reason for nearly all possible parts in the locomotive to catch fire. After the locomotive crew noticed the fire, they did not switch off the engine fan, which contributed to the expansion of the fire. It should be noticed that none of the indications and safety devices of the locomotive were activated, although the fire was already burning. The locomotive switched off only when the fire destroyed the electricity conductive parts and interrupted its power supply. The actions of the locomotive engine drivers and those of the engine driver assistant indicate that they were not gathered in the emerging environment. As a whole, their actions did not lead to preventing the complete burning/destruction of the locomotive. For this reason they could not help the firemen get oriented properly and their actions were not efficient. The fire extinguishing was interrupted so that the brigades could fill in the water tanks, which furthered to the final negative result.

12. Analysis of the causes of the railway accident

As is well known, the bigger part of the locomotive fleet of "Holding BDZ" Inc. is old and strongly worn out. The series of locomotive incidents and accidents over the last months, as well as the worrying peak of fires, justify the hypothesis that this is one of the main causes for the occurrence of the accident with locomotive No 44081.8.

The fire emerged and expanded in the time interval between 11:02 p.m., (the time when the train departed from Aytos station) and 11:06 p.m. when the train stopped finally at km 254⁺⁰⁰⁰ (as evidenced by the speed measuring tape's readings of locomotive No 44081.8). During the train stop at Aytos station, the locomotive crew did not establish any signs of burning in the locomotive. The locomotive moved with the second control cabin ahead. After departing from Aytos station the train accelerated and after about 1 min it started running at 100 km/h covering a distance of about 2000 m. It continued moving at this speed for one more minute and passed additional 1300 m. The train covered 500 m moving by inertia and the speed reached 90 km/h. Then the train was delayed by the driver and by using the train brake and the speed decreased to 40 km/h. Acceleration began immediately afterwards until the speed of 60 km/h was reached – the speed at which the relevant section was to be passed. At the moment of reaching 60 km/h, the train starts slowing down - because of the locomotive's transition from *towing mode to idling mode*. The train covers 500 m in this condition until it reaches a speed of 50 km/h, then it is delayed with the automatic train brake and the train is set in place after running about 200 m from the moment of detainment.

At the time of locomotive's inspection executed by the Investigation Commission from the Ministry of Transport, Information Technology and Communication at Locomotive Depot Plovdiv, it was established that despite the high degree of combustion in the engine compartment, the outbreak of fire occurred in the area of the traction rectifier cabinet of the first traction group. The traces of fire ignition and the analysis of the preceding events show that it is most likely that ignition has occurred in towing mode of locomotive's operation, with strong current passing through the locomotive traction subsystems. Such a mode of operation of the locomotive was evidenced several times during its movement from Burgas station, but the last such operations occurred after its departure from Aytos station and upon its acceleration on entering the speed reduction zone, shortly before its final stop at km 254⁺⁰⁰⁰. Considering the fact that the burning out of such strong fire needs time, as well as the circumstance that during the stay at Aytos station

the locomotive crew did not notice any signs of fire, it may be assumed that the fire burned up after the train departed from Aytos station .

13. Recommendations and proposals for measures preventing other accidents of a similar nature

In view of improving the level of safety and prevention of other accidents of similar nature and in relation to the requirements of Art. 94, par. 1 of Ordinance No 59 dd. 5.12.2006 on the management of railway safety in railway transport of the Minister of Transport, the Railway Administration Executive Agency shall order the introduction and implementation of the rendered safety recommendations, as follows:

1. Carrying out an immediate inspection of the fire-fighting installations and the major safety systems of all locomotives.

2. Strengthening the control over the locomotive operation inspections at the major and the turnover depots and at the operating stations.

3. Mounting of additional sensors to the fire alarm installation and spraying nozzles to the fire-fighting installation in the fire hazard zones.

4. Modernising of the locomotives from series 44 and 45 by building of new locomotive fire alarm and firefighting installations.

5. Strengthening the control on the inspections and check-ups of the electric equipment condition according to the ‘Rules for BDZ electric locomotive repair and maintenance at locomotive depots.’

6. Strengthening the control on observing the standards of admission in use of electric machines and apparatuses in locomotives, according to the ‘Rules for BDZ electric locomotive repair and maintenance at locomotive depots.’

7. Carrying out of periodic training of locomotive staff in the set-up and operation of locomotive firefighting installation and in actions in case of fire in the railway rolling stock during movement.

8. To improve the coordination of interaction between various operating services at the National Railway Infrastructure Company with licensed railway carriers at the occurrence of accidents and incidents in accordance with Ordinance No 59 and Ordinance No 58.

In relation to the requirements of Art. 94, par. 4 of Ordinance No 59 dd. 5.12.2006 on the management of railway safety in railway transport, the addressees of the recommendations shall inform in writing the Chairman of the Investigation Commission at the Ministry of Transport, Information Technology and Communication about the actions undertaken in implementation of the recommendations given.

Chairman:

Boycho Skrobanski

State Inspector at AMRAI Directorate