

8. THE CAUSES AND AFTERMATH OF THE MAJOR FIRE IN 1993 AT THE KAMSKI CAR PLANT IN RUSSIA

B.N. Porfiriev and A. K. Mikeev

Introduction

On April 14, 1993 a major fire occurred at the largest truck plant in Europe, this being the Kamski plant in Russia (KamAZ is the Russian acronym that we will use in the rest of the article). The fire was finally contained after a week of enormous effort. Even though there were no fatalities because of the disaster, it is probably the worst in the car industry both in the former Soviet Union and the CIS (Commonwealth of Independent States), and one of the largest scale technological disasters in Russia in the 1990s.

During the extinguishing of the fire and afterwards, the plant supervisors as well as representatives of the responsible governmental bodies, the State Fire Service (SFS) in particular, as well as independent experts and journalists expressed their views and assessments concerning the causes and scale of the fire. A few surveys providing details of what had happened were also published (see, Pozhar na KamAZe: Fakti, 1993b). Nevertheless, important aspects of the occasion and its anatomy from the viewpoint of an emergency management analysis have not been researched. In part, this has led us to prepare the following preliminary case study.

A Brief Description of the Scene and the Fire

The KamAZ truck complex is located in the city of Naberezhniye Chelni on the banks of the Kama River, a tributary of the Volga River. The city is 125 miles east of Kazan, the capital of the Tatarstan Republic within the Russian Federation. Before 1930 it was a small community, and then received the status of a town and later that of a city where there now live more than 500,000 people. The truck manufacturing complex includes many units in Naberezhniye Chelni as well as in other regions and towns of Russia (Bolshoi, 1991).

One of those units was the engine assembly plant employing about 19,000 workers and producing 600 truck engines every day. It consisted of a one story building that was 1,152 meters long, 363 meters wide and up to 14 meters high with a steel roof covered by a sandwich like heating layer composed of foamed polystyrene 50 mm. thick and four layers of rubber-bitumen mix. In the basement of the building, nine meters underground, there was a complex of tunnels used for assembly operations and also for storing a metal shavings conveyor, as well as oil, lubricant and coolant tanks. The plant was equipped with hydrants mounted on 300 and 400-800 mm. fire prevention water pipes, automatic sprinkler and drencher systems for water and foam fire extinguishing purposes; and had a special paramilitary unit of 67 firemen. The total number of fire fighting personnel at the KamAZ complex consisted of 424

Deep and Direct Causes of the Fire

An analysis of the fire's prehistory discloses it to be the logical and in some respect the inevitable result of a continuous causal chain of events, and a mixture of socioeconomic (external factors) and interdependent human, organizational and technological loopholes (internal factors), within both the KamAZ complex and its engine assembly plant. As argued by many researchers who have done industrial crisis studies, this set of factors is organic in nearly every technological incident or accident (see e.g., Turner, 1978; Lagadec, 1982; Perrow, 1984; Mitroff, Pauchant and Shrivastava, 1988; Meshkati, 1991; Quarantelli, 1992). We also consider it helpful to introduce a time parameter into the analysis of the massive fire subdividing that set into deep or antecedent, and direct or immediate prerequisites and causes (see Porfiriev, 1993).

The final links of the aforementioned causal chain are undoubtedly embedded within the organization, i.e., both in the KamAZ complex as a whole and in particular in its engine assembly plant. The responsibility for what happened is primarily that of the chief executives who failed to provide: (a) adequate fireproof design and construction by using incombustible or fire-resistant materials (given that polystyrene burns very fast and emits large quantities of thermal energy and toxic substances), and (b) effective fire prevention and counterfire measures including technological auditing, control and alarming system. The latter predetermined the plant's continual vulnerability to fire and eventually turned out to be the main direct prerequisites for the April 1993 incident.

At the same time, the initial and perhaps the key elements of the causal chain lies far away from Naberezhniye Chelni and KamAZ. We believe that the roots of that and similar major fires result from erroneous, long-term socio-economic policies in the earlier Soviet Union and from drawbacks of recent reforms in Russia. The former includes the mentality and way of actions of policy creators and executors, including the chiefs of the federal departments of industries as well as major state enterprises. The later reform was and is still oriented to a short time perspective on financial and production benefits, at the expense of the long term social interests--including fire safety--of the affected populations, communities, and the sustainable development of regions.

Deep or External Prerequisites:

Political, Economic, Organizational and Legal Aspects

The history of using foamed polystyrene (or more briefly, polystyrene) as construction material can serve as a good illustration of an important point. Polystyrene production emerged in the Soviet Union in the early 1960s as a response to demands from the rapidly developing massive construction of large, massive plants needing new light and relatively cheap heating. Erection of those plants was considered as very efficient and therefore was set as one of the priorities in the nation at the federal level for both industrial and construction development until the early 1990s. Polystyrene began to be widely used thanks to its low specific gravity and thermal conductivity, durability, and convenience for operations. Being used with steel elements it considerably decreases the total mass of buildings (e.g. compared to ferro-concrete) providing economy on steel expenditures and cutting down on construction costs (Pozhar na KamAZe·Fakti, 1993b).

These characteristics of polystyrene played a key role in 1962 in the permissions standards used by the main governmental bodies of the USSR responsible for issuing or suspending norms or licenses for the erection and operation of industrial facilities (i.e., the State Construction Committee - the USSR's Gosstroy - along with the State Technological Inspection for Mining and Industry - that is, Gosgortekhnadzor). Following those standards, polystyrene could be used only after consultations with the state fire inspection agencies that had a right to discuss but lacked the power of establishing fire prevention norms. Naturally the construction companies ignored consultations with either foreign or Soviet chemists who might have noted that polystyrene was substantially hazardous, given its combustibility and toxicity.

In 1969, neglecting the opinion of fire service agencies, the Gosstroy issued permission for the use of polystyrene in metal fencing panels, and two years later in 1971, removed all restrictions and limits on using polystyrene in construction works. The USSR Ministry of Interior and its Fire Inspection Service tried to block that decision, appealing to the Cabinet of Ministers and some other governmental bodies to substitute for polystyrene by producing fireproofed materials. In 1971-1972, only a dozen such appeals were issued (Pozhar na KamAZe:Fakti, 1993b). But all those efforts were depreciated given the loose legal basis and the lack of a fire prevention act that provided broad powers to the Fire Inspection Service in fire standards development and control. They were ignored by influential industrial ministries, Gosstroy being the first, that had superior status within the executive power (the Soviet Union administration) than had the fire prevention service represented only by the Chief Board of Fire Protection (CBFP) in the Ministry of Interior.

In current day Russia the situation has been just about the same. The CBFP was replaced by the Fire Prevention and Rescue Service (FIPRES) and later by State Fire Service (SFS). It followed the Government of Russia regulation called "The Issues of Fire Safety Support and Organization of the State Fire Service within the Ministry of Interior of the Russian Federation". The regulation dated August 23, 1993 left in place the SFS with the status of a board subordinated to one of the Deputy Minister, as was true earlier. At the same time, this regulation provides some legal grounds to the SFS for developing and supervising fire rules and standards making this service a federal certification center for fire safety (Dedikov, 1993; Nazarov, 1993).

Nevertheless, considering that this document was issued instead of passing the Federal Fire Prevention Act (the draft did not reach the fall hearings of the 1993 parliament though it had passed through relevant committees in the summer), and thus posses smaller "legal weight", it would hardly be erroneous to doubt any radical shifts for the better in the next year or two. These doubts are further reinforced by the document's short life as well as its contradiction to some points in the Presidential Decree on Inspection Services in the Russian Federation. A lack of change would be true even if new conflagrations would necessitate accelerating drastic changes in fire safety support in Russia.

In this respect the situation in the Soviet Union in the early 1970s looks both typical and at the same time corroborates the last point we made. That situation did not change substantially even after several plants had suffered major devastating fires. These include the 1972 fire at the metal structures plant in Zhitomir, the Ukraine, which led to the

collapse of 17,800 square meters of roofing; the 1973 fire at the Bukhar cotton plant in Uzbekistan which resulted in the complete burning of more than 40,000 square feet of roofing. Moreover, in the same year Gosstroy developed and enforced code CH 454-73 for designing light metal structure buildings, which constituted a legal basis for the massive use of polystyrene while erecting key industrial facilities in Russia in 1970-1980s. Included among these were practically all nuclear power plants, 19 thermal power and heating stations, about 70 industrial giants like "Atomsmash", "Rostselmash", ZIL, etc. (Nazarov, 1993; Pozhar na KamAZe: Fakti, 1993b).

The KamAZ complex was one of the first such facilities; its construction started in 1973. During the course of construction, the CBFP several times urgently discussed at Gosstroy, the Car Ministry and the Cabinet of Ministers, some substitution for the polystyrene roofing in production units. But as usual, the decision was palliative. Instead of the recommended measure, Gosstroy issued an order to divide the polystyrene roofing with fire bars 6 m. wide thus segmenting them into a few sections of 10,000-12,000 square meters each. That order referred only to the units without roofs, though at that time the engine assembly plant had already nearly 80% of the covering mantled thus preserving combustible materials in all its main structures (Pozhar na KamAZe: Fakti, 1993b).

Besides the aforementioned thrust of the industrial ministries and the KamAZ chiefs to gain short term profits through cutting "non-productive" costs, including those for fire prevention and safety measures, the palliative decision about the polystyrene problem at the complex in 1970 was also the result of the position of the regional fire inspection organization regarding employees. That state body was much interested in maintaining the number of personnel in the fire units providing fire safety both for KamAZ and the city of Naberezhniye Chelni, and thus agreed to compromise with influential car and construction bosses (Pozhar na KamAZe: Fakti, 1993b). The next decade of the 1980s did not witness any substantial positive changes in views and actions towards solving or at least mitigating the polystyrene problem at KamAZ. As a result, more than 40% of the fire prevention measures prescribed by the fire inspectors in their instructions were ignored and shifted to later years. In the last five years, the fire inspection service administratively cited 711 engine assembly plant officials for breaking fire rules and regulations, partly or entirely doing something about the plant's sections considered fire prone or hazardous.

Just the same picture existed at the other major facilities using polystyrene in their structures. That led to the complete burning off of 26,000 square meters at the Kapchagay china plant in Khazakhstan in 1981, and the destruction of a considerable part of the roofing of the nuclear power plant in Zaporozhye, the Ukraine in 1984. As to the engine assembly plant of KamAZ itself, 57 fires occurred there in 1978-1992, and 32 incidents (i.e., faults, burnings, etc.) were registered in 1987-1993 alone (Pozhar na KamAZe: Fakti, 1993b).

Direct Causes: Technological and Organizational Failures

The Development of the Fire

At 6 41 p.m. on April 14, 1993, an electric fault burned through the weak protective armor of the cables, igniting them and thus triggering the fire at the engine assembly plant. The

flames started to spread along cables lacking fire protection partitions and moved towards the main control panel, and in 14-16 minutes reached it. From 6:55 p.m. on, within two or three minutes, faults were affecting several cables which caused an explosion of the transformer thus shutting off the plant's electricity supply and consequently suspending the main and then the reserve lighting and functioning of equipment. At 6:58 p.m. the fire left the surface (zero level) and ignited overpass structures. At that time about 20 sq. meters of the plant's structure were affected by the fire.

There was no automatic alarm system so workers began to understand what was happening only when the lights in their units went off. One worker was alerted by the smell of burning insulation from the electric substation, and on approaching it saw thick fumes coming from the door. In a minute, i.e., at 7:00 p.m., he called the operator of the plant's electric supply division and told him about the fire. Later on, the investigation found that the first indications of the fire including claps, crashes, etc., had been noticed around 6:45 p.m., but the workers thought they were routine industrial noises.

Meanwhile, within only three or four minutes, i.e., at 7:01-7:03 p.m. the flames enveloping the overoiled structures and pipes, reached the roof and melted the polystyrene and bitumen mixture. At that time, since there were no fire protection belts or any other obstacles, it spread quickly and freely at a speed of 6-8 m/minute and affected about 600 sq. meters of the roof. By 7:20 p.m. the affected area was 8,000 sq. meters and in 32 minutes when the first burnt parts of the roof structure collapsed, skyrocketed to nearly 10,000 sq. meters. By 8:19 p.m., this figure grew more than tenfold reaching 103,000 sq. meters and by 9:31 p.m. it increased to approximately 420,000 sq. meters.

Next day, April 15, by 11 a.m. the fire on the roof and on the surface (zero level) had been extinguished, but at 5:05 p.m. the situation in the tunnels (nine meters deep, total length and volume equaling to 6.8 kilometers and 344,000 cubic meters, respectively) worsened. The burning mass of polystyrene and bitumen flowed there from the roof igniting the tanks filled with oil. The struggle against the underground fire lasted until April 21 (Pozhar na KamAZe:Fakti, 1993b).

The Fire's Aftermath and Its Assessment

Surprisingly, the fire resulted in no deaths or seriously injured among the plant's personnel or the firefighters. Only two persons with light burns had to get medical treatment. This outcome was primarily due to the time of the incident, occurring during the lunch time of the second shift when the shops were empty, as well as to the high level training of the fire officers.

Therefore, the main result of the massive fire was the enormous economic damage, some stemming from the direct losses of valuable equipment and the rest from indirect losses caused by the interruption of the normal functioning within the KamAZ technological and marketing networks where the engine assembly plant played an important role. No one can provide exact figures of the damages and official estimates differ substantially; from tens of billions of rubles (Bronshstein, 1993a; Grigoriev, 1993) to hundreds of millions of US dollars (Mitin, 1993), with little explanation being provided for the vast differences in the

numbers.

To assess the direct losses of the fire, we started with the value of the plant. Recently, for its stock sharing that value was calculated as 109 billion rubles or about \$200 million. That essentially included the plant's basic value, primarily its expensive imported equipment and its buildings and other constructions. The value of raw materials and components lost in the fire have not been included in the aforementioned figure. Consequently, we assume that \$220 million could be considered as the total value of the plant prior to the fire. Taking into account that the fire completely destroyed all metal structures and cables, and from 50% (Pozhar na KamAZe: Fakti, 1993b) to nearly 70% (Nazarov, 1993) of the equipment, we believe that the direct damage should be estimated as about \$170 million or in the order of 190 billion of rubles (given April-May 1993 dollar-ruble ratios).

To obtain a figure for total damage one should also add the value of the indirect losses inflicted by the fire. These losses include the costs of extinguishing the fire, importing truck engines from abroad, shifting the KamAZ engines' traditional consumers to the engines of other suppliers, and relevant changes in transportation schedules, temporary professional changes and the retraining of the plant's personnel who lost their work jobs. It is suffice to note that the burnt plant supplied engines not only for KamAZ trucks but also for the Ural car factory, ZIL, some bus assemblies and some military plants. Some sources within the car industry believe that the KamAZ lost profits equal to hundreds of millions of rubles.

Having no statistics on specific consumers, plants and operations, it is not possible to calculate the earlier mentioned costs though there is still room for an expert assessment. If one takes the average proportion between direct and indirect losses--1/5 typical for aftermath of fires in Russia as a starting point for further calculations--the indirect and total damage of the KamAZ fire can be estimated as about \$850 million and \$1,000 million respectively. The latter indicator does not incorporate costs for the rehabilitation, or to be more precise, the construction of the new engine assembly plant that we discuss later

Both the cost of the fire and the recovery could have been much less if the plant had been insured. In the mid-1970s when the plant and the KamAZ complex as a whole were approaching the start of operations, their chief executives studied the prospects of insurance. Along with the viewpoint of experts from "Ingosstrkch", the only Soviet authority for insuring facilities involving foreign investments, the insurance premium at that time would have reached 0.5-1.0% of insured property or around 1,000 million of rubles (Mitin, 1993). But at that time there existed only state property and the unique state company, Gosstrak, so that it made no sense for most organizations to take such insurance liabilities on their shoulders. The KamAZ chief executives did approach US insurance companies who asked for a premium of \$150 million per year, but for the whole KamAZ complex. That figure seemed to be unreasonable and the contract was not made. But as it turned out the April 1993 fire was worse than the worst forecasts (Bronshstein, 1993a; Nazarov, 1993)

Response to, Recovery and Mitigation of the Fire's Aftermath

The emergence and fast spread of the fire within the whole plant served as a catalyst for response activities, primarily the KamAZ fire service responsible for detecting localizing.

extinguishing of fires and mitigating the aftermath of any incident. In general, the activities of the fire service can be considered as having been fairly effective. But some important issues draw our analytical attention first of all to the operativeness and reliability of the warning as well as the automated fire control systems

The systems existing at the plant failed to function as they should have. In particular the automated fire control system did not work because of the failure of the main electricity supply at 6:57 p.m. and the reserve supply seven minutes later. That was one reason why the warning about the explosion of the electric transformer and the news of the fire itself reached the plant's fire unit only at 7:00 p.m., that is, with a 19 minute delay, and why 11 fire section units came to the scene only four minutes later at 7:04 p.m. That 23 minute delay facilitated a 30 fold increase of the burning area which was visibly augmented by a strong wind (Pozhar na KamAZe: Fakti, 1993b).

As to organizational response, considering the seriousness of the situation, the commander of the KamAZ fire protection service set up an operative headquarters to combat the fire. He also ordered a #1 fire emergency for the city of Naberezhniye Chelni, initiated the evacuation of personnel from the plant and the plugging in of tank trucks into hydrants. At 7:20 p.m., taking into account that the wind was increasing the speed of the spread of the fire from 6-8 to 10 meters per second and aggravating the fire's impact, the commander appealed to higher level chiefs to declare a #1 fire emergency for the Tatarstan Republic. By 7:25 p.m., he had activated all fire protection personnel and deployed all equipment reserves. However, these measures failed even to localize the fire due to the inadequate water supply which was only 600 liters per second or 30% of the needed volume. As a result, by 7:52 p.m., more than quarter of the roofing was on fire, some metal structures had crashed and collapsed, and flames were encroaching yet unaffected areas and sometime enveloping fireofficers on the scene.

By 8:19 p.m. the operative headquarters for extinguishing the fire, supplemented by engineers from the plant, finished deploying the means and forces that arrived from the city of Naberezhniye Chelni. All the fire personnel were grouped into nine combat units, using about 30 pipes. Later on, when the burning area had already exceeded 100,000 sq. meters and following a Republic level fire alarm #1, fire units reinforced by civil defense units came from the neighboring cities of Nizhnekamsk, Almetievsk and Elaguga. However, they still failed to stop the fire and by 9:31 p.m. the entire roof of the plant more than a kilometer long was on fire.

At 00:47 a.m. the next day, the deputy chief of the Fire Prevention and Rescue Services of the Tatarstan Ministry of Interior, together with an FIPRES task force came to the fire site. Two hours later (at 2:50 a.m.) the head of the FIPRES of the Ministry, a general, arrived escorted by another FIPRES task force. These commanders redeployed means and forces, augmenting the latter through using neighboring fire protection units. They also organized a reconnaissance in the tunnels where the level of water reached one meter. At 5:05 a.m., the Chief of the FIPRES of the Russian Federation, another general, came from Moscow to the fire site.

Because of this tremendous effort that in particular facilitated an increase of the rate of the

water supply to 720 liters per second, by 11.00 a.m., April 15, the situation at the surface level had come under control. But the problem in the tunnels kept getting more alarming since flames were directly approaching oil tanks. The thick smoke and high temperature (500-600 C) as well as the narrowness and limited number of entries into the tunnels prevented firemen penetrating into them (Pozhar na KamAZe: Fakti, 1993b). The operative headquarters took a decision within 26 hours to pump the foam from 45 generators and to isolate other holes with mineralized wadding, thus inhibiting the flame's intensiveness and limiting the access of oxygen to the fire zone. Such measures resulted, first, in a lowering of the temperature in the tunnels to 120-140 C and also from more massive and effective use of the foam generators.

On the fourth day of the fire, on April 17, a new serious problem emerged with the spreading of the fire to the oil and diesel fuel tanks in the engines' testing station located 5.2 meters beneath the surface. The operative headquarters issued an order to isolate the station by using bricks and gravel to block the tunnel between it and the main basement. The station was saved and on April 21, the massive and complicated fire was at last contained.

The composition of the staff of the operative headquarters that directed the fighting of the fire, and at the final most responsible stage headed by the Chief of the FIPRES, changed every day. It included personnel from such unit as signal; information and documentation support; safety; material supply; repair and technical support; rear support divisions headed by officials from the plant's administration; the city fire protective service, the FIPRES of Tatarstan and Russia, among others. In total, 560 firefighters and 54 civil defense servicemen (not considering a medical emergency brigade), were engaged in fighting the fire from the city of Naberezhniye Chelni and adjacent Nizhnekamsk, Almetievsk, Elabuga along with those from more distant areas such as Kazan city, the Udmurt and Bahskortastan Republics, as well as Samarskaia and the Nizhegorodskaja regions of Russia. They were equipped with 64 pieces of fire fighting equipment, 236 various kinds of machines and gears and used more than 2,400 tons of foam generator and 110 tons of foam powder (Pozhar na KamAZe: Fakti, 1993b).

The main result from the fire fighting efforts were no casualties and a saving of up to 50% of the production equipment, 85% of the building columns, and 40% of the walls, although in general the work in the plant had to be suspended and workers could not do their jobs. Despite that, there were no massive discharge of personnel. In the following six months, only 33 persons or less than 2% of the plant's staff were fired, included 21 who were retired on pension (later eight persons from this group were reemployed at KamAZ). Part of the plant's personnel got temporary retraining to become construction workers and took part in the accelerating rehabilitation of the ruined plant that relied on the means and forces of KamAZ itself. There also were no cut off of social security and support measures, pensions, cultural and other development programs of KamAZ (Bronshstein, 1993b; Grigoriev, 1993).

As to the legal response to the fire, the Council of Ministers of Russia on April 21 issued an order creating a special commission to investigate the circumstance of the start and the

development of the fire at the plant. The commission confirmed that the plant's unprotected metal structures covered with polystyrene both made it fire vulnerable and left the firefighters unable to combat effectively the destruction of the plant. It also formulated technical and organizational recommendations; however with limited validity since the fire service status remained the same. In this sense, paramount was the implementation of the earlier mentioned Government of Russia Regulation, dated August 23, 1993, concerning the creation of a Russian Federation SFS with power to set fire standards and control responsibilities.

The substantial damage inflicted by the fire predetermined the large scale nature of the recovery activities. According to the KamAZ company president, only the initial phase of these activities including the acquisition, construction and fitting of 100,000 tons of metal structures, 1,260 kilometers of electric cables as well as the purchasing and mounting of hundreds of tools, would require spending 150 billion rubles. Based on these figures, some experts believe the total spending on the plant's rehabilitation would skyrocket from \$140 to \$400 million (Mitin, 1993; Nazarov, 1993; Pertsevaia, 1993; Vishnevski, 1993b), or in other words from 1/7 to 2/5 of the aforementioned total losses. If \$300 million is considered a right guess, we would reckon that the fire's total costs covering the sum of the total losses and reconstruction costs would reach \$1.2-1.25 billion.

It is possible that the recovery work initially planned to take no less than a year, could be performed faster due to assistance from business partners (i.e., component suppliers and truck engine consumers), and 11,000 volunteers, including construction and assembly workers, from Konetsk in the Ukraine, Akmolinsk in Khazakhstan, Ufa in Bashkortastan, and other cities and regions of Russia and the CIS countries that had come to KamAZ in May-September 1993. They, working 12 hours a day, erected the roof over the undestroyed part of the plant.

The unburned equipment was retrieved from the ruins and put into the spare sections of adjacent KamAZ complex plants where it was immediately used, like in World War 2. In addition, the stockholders of the KamAZ company by refusing the 1993 dividends made a substantial sum of money flow into the plant's rehabilitation fund. The government of the Republic of Tatarstan also introduced temporary tax discounts. These and some other extraordinary measures resulted in the daily assembling of 250 large truck engines as early as the end of April 1993, while 1,700, 3,000 and 4,000 pieces were planned to be produced by October, November and December, 1993 respectively. By January, 1994 the KamAZ board of directors were hoping to reach the level of producing 100,000 engines yearly (Bronstein, 1993b; Morozov, 1993a; Morozov, 1993b; Ukhov, 1993a; Vishnevski, 1993a).

At the same time, there are factors hampering clearing up the disaster's aftermath and the rehabilitation of the plant, in particular those embedded in the continuing economic crisis in Russia. So, despite a few regulations issued by the Russian government concerning the plant's reconstruction investments, by September 1993, nothing had been really allocated from the established sum of 30 billion rubles. The same thing occurred to the preferential (low interest) credits of 45 billion rubles (earlier thought to reach perhaps 75 billion rubles) to be provided from the federal budget. From 50 billion rubles of free federal assistance

authorized for the plant by the Supreme Council order, only five billion rubles or 10% were actually transferred, while the 20 billion preferential credit was given at an interest of 160-170% yearly, i.e., as regular commercial credit (Bronstein, 1993b; Vishnevski, 1993a). That consequently led to the KamAZ company' indebtedness to suppliers and construction firms as early as June 1993, equal to 90 billion rubles (Vishnevski, 1993b).

In order to keep paying salaries to personnel, the KamAZ administration also had to obtain credits from commercial banks that initially were ready to provide up to 500 billion rubles for reconstruction. But this was refused by KamAZ chiefs who preferred assistance from governmental sources that however turned out to be not reliable enough. Just to pay the commercial credits back, the KamAZ administration was forced to sell part of its hard currency reserves accumulated through export operations, cut the speed of residential building construction and take some other restrictive measures to save necessary resources (Bronstein, 1993b; Ukhov, 1993b; Vishnevski, 1993a).

The Fire in the Mirror of Public Opinion and the Mass Media

The response towards the fire of the Russian community, especially the residents of Naberezhniye Chelni and neighboring communities, was not uniform. No doubt, the aftermath of the disaster arouse in people feelings of sympathy, cosuffering, and an eagerness to help that for centuries has been typical towards those who lost their possessions in a fire in Russia. Just in the first dreadful night, while the fire was raging at the plant, many of its workers and citizens of Naberezhniye Chelni started to collect money for its reconstruction. Some sacrificed their savings, some gave part of their salaries to a special rehabilitation fund established in April (Ukhov, 1993a). As mentioned earlier, many volunteers from different regions of Russia and the CIS countries came to help and provided assistance for months. During the full duration of the fire, the KamAZ administration got moral support from the city's religious communities of different faiths (Vishnevski, 1993a).

Nevertheless, as far as the causes of the fire were concerned, the city was full of rumors that treated the disaster as revenge by racketeers that had been refused payment, or by some other offended persons. Interestingly, the director of the plant himself, has been continuing to support a version of arson, while local nationalists accused him of the latter in favor of shifting the KamAZ property priorities from Tatarstan to Russia. They proposed that the public prosecutor start a law suit and nationalize the entire complex. Other persons saw the fire as resulting from the heavy drinking of plant personnel after getting paid. There were also many rumors that touched on the response to the fire. Some people said that eight firefighters had perished in the plant's ruins, and the local newspaper, "Meschanka" reported that three workers had died although giving no evidence to support the report which was actually incorrect (Bronstein, 1993a; Bronstein, 1993b; Morozov, 1993b).

Lacking any opinion polls relevant to our subject matter and thus any representative data, it is only possible to make the general observation that in general the response of the local communities to the disaster appeared as calm and rational. People did not waste much

time discussing the situation but instead started actively to restore and construct the facilities so the plant could function again. This was facilitated by the constructive policy of the KamAZ administration as well as the generally moderate tone of communications in the mass media. The latter responded to the fire by reporting on April 14, the event in the evening and night news of local TV and radio and in the main federal TV channels ("Ostankino" and "Russia"). Next day, reports were published in newspapers.

The newspapers were the most interested parties in reporting the incident. This can be seen in what was reported in five newspapers including four dailies (Izvestia, Komsomolskaia Pravda, Pravda, and Trud) and one weekly (Moscow News). Being issued from hundreds of thousands to several million of copies and distributed throughout Russia, in the CIS, and even some Western countries, the reports on the media perception and assessment of various events, both routine and extraordinary involving the fire at the KamAZ complex, had considerable impact especially on the Russian audience.

The aforementioned newspapers followed the well known pattern of disaster media news reporting which has been called "better than reported but worse than necessary" (Scanlon, Luukko and Morton, 1978). There was unevenness in both frequency and depth of reporting. No more than one article or comment per day appeared for nearly six months following the disaster (for comparison, the radiological accident at Tomsk-7 in 1993 was discussed in the press for just two months). Within that time span, 15 stories amounting to 2,369 lines were published about the KamAZ fire in these newspapers or, in other words, one article or comment was published each 11-12 days. That is certainly much more than was the case with regard to Chernobyl not to say about Kyshtym.

A dynamic analysis of these publications disclosed that brief official comments in the first three days of the fire was replaced by substantially more detailed information. The volume increased from an average 19 lines in April 15-17 to 349 lines in April 18-20 or 18 times more. If recalculated for an average daily indicator, the increase is not so impressive, but still remains considerable equaling to 3.5 times more; from 19 to 64 lines, respectively (see Figure 1).

Further, a typical declining trend followed which reflected the decreasing acuity of both the real situation and its perception by the public, consequently blunting mass media interest given its usual seeking for sensational material. The decline started a week after the containing of the fire and lasted until nearly mid-May. The average volume of the newspapers during April 29-May 13 went down to 73 lines. that is, to 15 lines if the average daily indicator is used, or by more than four times.

The following week, from May 14 to May 21, a new wave of public and mass media interest in the KamAZ fire arouse perhaps being stimulated by the termination of the preliminary investigation by the governmental commission that had obtained fairly exhaustive information about the disaster from SFS officials. The number of publications within the mentioned period if compared to the previous one, shows an increase of 2.5 times and their volume of 6.6 times. In the next four and a half months after April 15, only sporadic articles were published and the most detailed mostly in two of the newspapers "Izvestia" and "Komsomolskaia Pravda" along with "Trud"

Fig.1 The volume of publications within April 15 - October 5, 1993

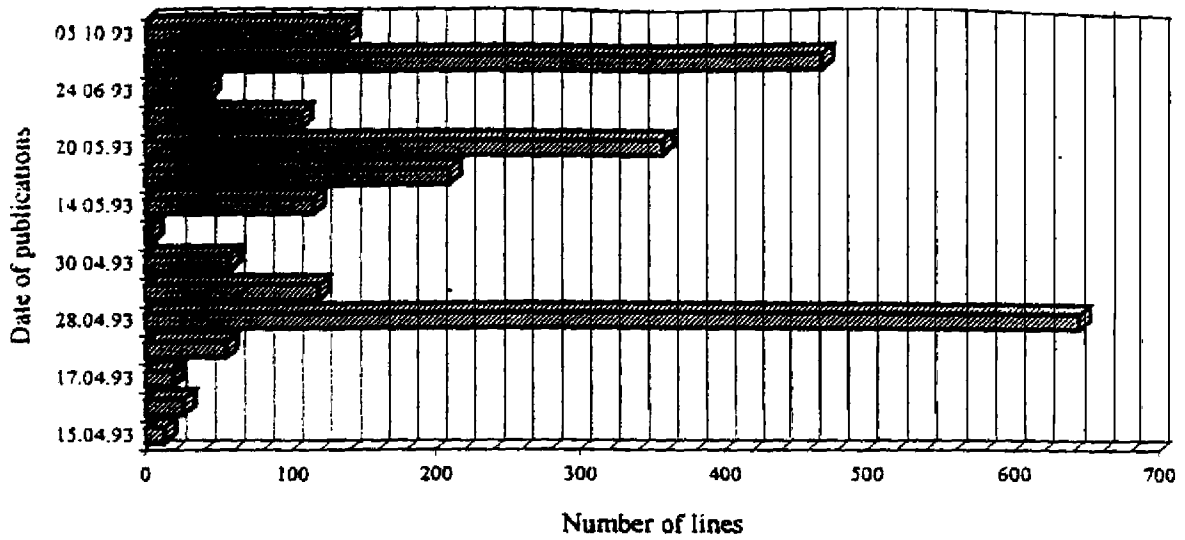


Fig.2 The number of publications within April 15 - October 5, 1993

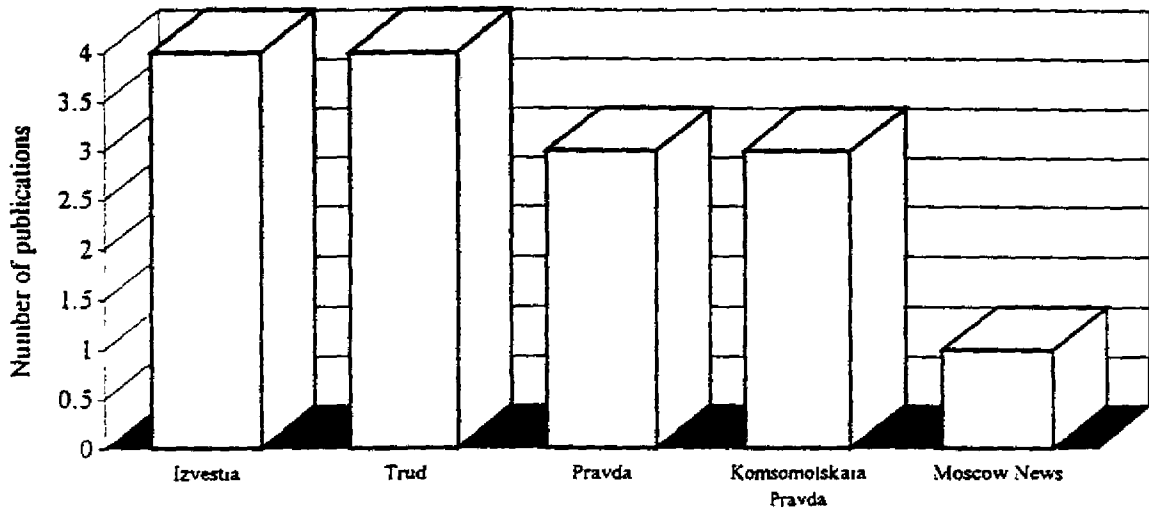
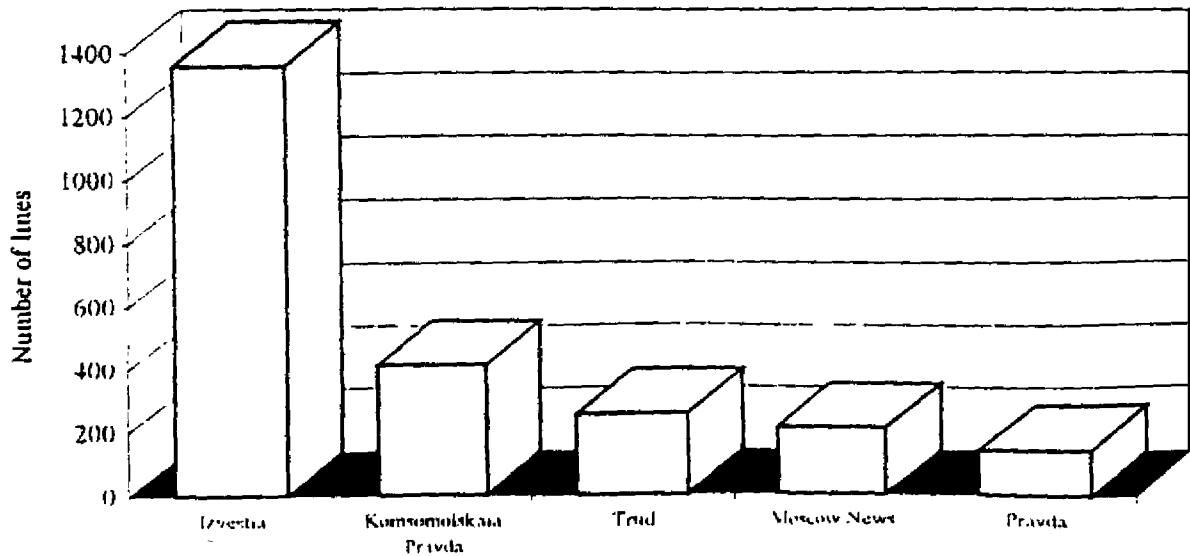


Fig.3 The volume of publications within April 15 - October 5, 1993



A content analysis of the news reports reveals a pattern fairly typical of mass media reporting of emergencies and disasters. First, during April 15-17, there were brief reports on the fact of the fire along with laconic comments on its causes and aftermath, primarily stating there had been no fatalities but substantial material damage. Later there were more detailed reports with descriptions of the technical and economic aspects of the fire, and forecasts on the prospect for the plant's revival in the future.

At the same time, the newspapers only slightly presented the alternative views of different experts on the incident's causes and aftermath, as well as "nonofficial" data. The news reports also lacked any serious discussion of organizational or legal and socio-economic issues of the disaster. In general, these news stories showed a mass media trust of the data and information issued by the major fire department in the country. This looks rather untypical for Russia where usually information from official sources have been treated as non trustworthy (for the situation in the United States, see Quarantelli, 1981).

Conclusion

Our system analysis of the major fire at the KamAZ engine assembly plant confirms that it was one of the most severe and large scale incident in Russian industrial history. It is not by chance that a number of experts and commentators have treated it as unique and often compared it with the Chernobyl. No doubt, one would have very loose grounds for putting the latter and the KamAZ fire in the same category if socio-medical, environmental or psychological criteria were used in assessing their aftermath. There is also a wide gap, perhaps reaching two orders of magnitude, between them in terms of economic or material damage. There are also pronounced differences between them in preparedness and response patterns; the effectiveness of counteraction in the case of the fire was clearly and understandably higher than in Chernobyl.

Nevertheless, these two technological disasters really do have something in common even granting all the aforementioned comparisons are correct. First of all, there is a commonness concerning the deep or antecedent and direct or immediate causes in both cases. This includes a combination of flaws and irresponsibility, a neglecting of technological—including fire prevention—safety standards stemming from and facilitated by an environment of legal vacuum in the field of safety and security, and in the vicious socio-economic development policy of the country in the previous decades.

There is also a certain similarity in response in the Chernobyl nuclear disaster and in the KamAZ fire. In particular, in both, the fire service displayed the highest preparedness potential, and an eagerness and capability to act selflessly and effectively. Also somewhat comparable is the time span for containing the situation in its acute (or emergency) phase of development. In the case of Chernobyl it took 15 days to stop the massive radiation emission from the damaged reactor, while at KamAZ the fire was extinguished completely in a week. But the qualitative gap in the aftermath of the crises, explicitly predetermined the substantial differences in rates, scales and essence of recovery activities in both incidents.

These similarities confirm and illustrate the urgent necessity and validity of not only

scrutinizing the lessons of a well known Chernobyl, but of other not so well publicized incidents and accidents, such as the major fire at the KamAZ plant. The latter experience should be comprehensively studied and considered for practical purposes at all levels of public management and administration, including the legislative sphere. The case could also be extensively used by executive bodies, including the fire, rescue, civil defence, medical and other services providing technological safety for large industrial facilities that objectively are often hazardous and risky.

Besides treating the KamAZ fire as a large scale incident useful as lessons for plant personnel, city residents, regional communities, etc. as well as the authorities and lay persons, it may also be considered as a peculiar accelerator of the KamAZ technological development. A contract signed in late 1993 with the US company CUMMINS providing 15,000 high quality engines for KamAZ trucks while the burnt plant is being reconstructed (and later on establishing a joint venture for producing engines directly at the KamAZ complex) has created favorable prerequisites for the latter to turn by the year 2000 into a model truck exporter to the world market (Arifdzhanov, 1993; Pozhar Kak, 1993a).

The large investments that would reach \$500-600 million by 1996-1997, would facilitate producing 50,000 engines daily that would increase the share of exported KamAZ trucks from a current 12% to 30%. Meanwhile, the engines of the US company will supply only a quarter of total production, the other 25% would be assembled using the most modern Russian R & D outputs, and the last 50% or 100,000 units would rely upon current technology. There are also projections for the development of a new modern truck equipped with an engine of 210 to 400 horsepower, although that would demand substantial time and resources that are scarce at the present time (Arifdzhanov, 1993). The successful implementation of such perspectives will not only be dependent on propitious organizational and financial conditions, but also on positive coping with fire and technological safety issues, thus preventing a repeating of the dismal event of 1993.