

CHERNOBYL 20 YEARS ON

Meet the helicopter pilot who spent months flying through radioactive dust; the engineer who saw the first three men die; the family evacuated with 40 minutes' notice... Two decades after the world's worst man-made disaster, **Adam Higginbotham** enters the 30km exclusion zone. Photographs **Andy Hall**

★ It's late and growing colder; darkness gathers in the stairwell, and nothing breaks the silence but the grinding of broken glass underfoot. Outside, the February snow has settled deeply around a Ferris wheel no one has ever ridden; the clock above the municipal swimming pool remains frozen at six minutes to 12.

Long after everyone had left, the streetlights still came on every night, and his secret visits to the empty town would frighten Valeri Sluckij a little. But now, at 59, he is used to it: 'It's hard,' he says. 'I spent the best years of my youth



here. But you can get used to anything.'

Up on the fourth floor of the building on Stroytely Street, Valeri stands in the living room of his old flat, beside the gutted carcass of his TV set; the green botanical-print paper curls from the walls. On the day they left, Valeri, his wife Natalia and their two children were given 40 minutes to pack their belongings.

'We thought we were coming back,' he says. 'So we just took a few things.' They filled five plastic carrier bags with their papers, Natalia's English textbooks, a few science fiction novels and a handful of cutlery.

And on the evening of 27 April 1986, Valeri carefully locked the door of the flat behind him and joined his neighbours on a fleet of buses that would take them to a small village 70km away. That night, 21,000 people were evacuated from the town by bus. They were told they would be back in three days. But nearly 20 years later, the deserted streets of Pripyat remain at the

Above: in recognition of his work at Chernobyl, helicopter pilot Sergei Volodin receives a special annual pension of 26 Ukrainian Hryvna - a round of tea costs 35. Left: the encased remains of Reactor No 4

heart of a 30km exclusion zone, protected by three paramilitary checkpoints: the most radioactive town on earth.

At 1.23am on 26 April 1986, a series of explosions destroyed Reactor No 4 of the Chernobyl nuclear power station, three kilometres from Pripyat in the then Soviet Republic of Ukraine. Fifty tons of uranium fuel from the reactor core vaporised immediately, and were blasted high into the atmosphere; a further 70 tons of uranium and 900 tons of highly radioactive graphite were dispersed into the area around the ▶



◀ reactor, starting more than 30 fires; the 800 tons of graphite that remained in the reactor core caught fire at once, creating a radiological inferno that would burn for 10 days, sending a continuous plume of lethal radionuclides roiling into the sky. The Soviet government would wait nearly three full days before acknowledging that an accident had taken place, and did so only after the drifting plume set off radiation alarms in a nuclear plant in Sweden. The contaminants, which included plutonium isotopes with a half-life of 24,360 years, eventually travelled around the globe, depositing radioactive material as far away as the lakes of Japan and the hill farms of North Wales. It was not merely the most devastating

accident in the short life of the nuclear power industry; it was the greatest man-made disaster in history.

There were 176 operational staff on duty at the Chernobyl plant that night, and the subsequent efforts to contain the results of the disaster would eventually involve more than half a million men and women. Many of them were subjected to enormous doses of radiation; some were killed instantly; others died agonising deaths soon afterwards in the Ukrainian capital Kiev, and in the specialist radiological wards of Moscow's Hospital No 6. The doses received by the hundreds of thousands of soldiers and reservists – 'liquidators' – who decontaminated

the poisoned landscape of Ukraine and neighbouring Belarus were either classified or never officially recorded.

Those that survived have lived to see the events of those days in 1986 clouded by myth, disinformation and controversy. The official account of the Chernobyl disaster was originally documented by a Soviet state only five years from total disintegration. The men who worked at the plant were made scapegoats for what

From left: chief engineer Alexander Yuvchenko – after a minute's exposure his skin turned black and sloughed off; fireman Anatoli Zakharov, one of the first on the scene, lost 12 of his 28-man crew



happened, and became victims of the last Soviet show-trial ever staged. The long-term health effects of the accident continue to be the subject of statistical debate and manipulation by governments, NGOs, scientists and doctors around the world. Now, nearly 20 years after the disaster, the survivors of Chernobyl are scattered across the former Soviet Union, gradually succumbing to cancer and early heart attacks.

Sitting nervously over a cup of tea in the foyer of a Kiev hotel, retired helicopter pilot Sergei Volodin taps the medal given to him by the president of Ukraine in 1996; it's the same one that 10 years before had been posthumously awarded to the firemen killed fighting the blaze at

Reactor No 4. 'In 1986,' he says, 'the firemen were all awarded it for dying. After 10 years, we were awarded it for still being alive.'

Friday, 25 April 1986, was a warm day in Pripjat, more like summer than early spring. Alexander Yuvchenko, the chief mechanical engineer of the No 4 reactor department, was scheduled to work the late shift that night; that afternoon, he took his two-year-old son Kirill for a ride on the handlebars of his bike.

Twenty kilometres from Chernobyl, the ancient Ukrainian town from which the power station would take its name, Pripjat had been built from scratch in 1970 to house the staff of

the nuclear plant; the average age of the new town's population was 27. The station – with four reactors already online and a fifth and sixth under construction – was planned as the largest nuclear power plant in the world, and regarded as a prize posting for engineers. Pripjat was a model town, renowned as one of the finest places to live in the entire Soviet Union. Those who visited at the time would later remember it idyllically, filled with roses and children.

That night, Reactor No 4 was due for a long-postponed safety test, to assess the systems' ability to keep the reactor core cool in the event of a power cut. No 4 was a 1,000 megawatt RBMK reactor – a colossal structure composed of 1,660 ►

◀ 10-metre-long channels filled with uranium fuel, separated by 1,700 tons of moderating graphite arranged into 2,488 columns. The power of the reactor was regulated by 211 boron carbide control rods, raised or lowered into the reactor core to modulate the rate of reaction. Protecting the station workers from the radiation of the reactor was a steel and concrete biological shield three metres thick and 17 metres in diameter. The technicians called this the *pyatachok*, or 'five kopek piece'.

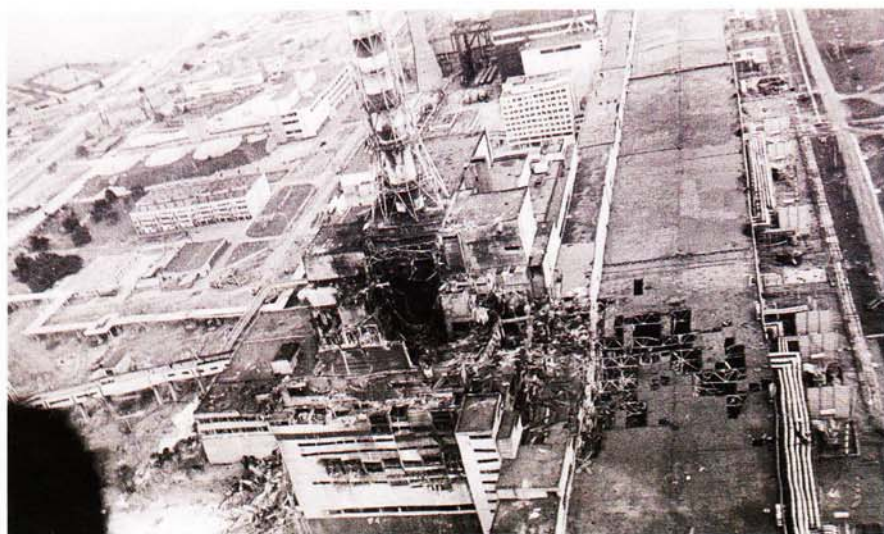
The RBMK was regarded as the workhorse of Soviet atomic energy, thrifty and reliable – and safe enough to be built without an expensive containment building that would prevent the release of radiation in the event of a serious accident. In fact, the reactor had serious design faults: when run at low power it was dangerously unstable and difficult to control; additionally, for the first four seconds after being inserted, the control rods would do the opposite of what they were supposed to – instead of slowing reaction, they would cause a sudden power surge. Under normal conditions these faults were not regarded as dangerous; but were the reactor ever to be pushed beyond its normal limits, they could prove catastrophic.

And in the early hours of 26 April, all the somnambulant working practices bred by the Soviet Union's years of stagnation – bumbling management, bad design and an expedient disregard for rules – fell into deadly alignment around Chernobyl's Reactor No 4. The safety test commenced with the unstable reactor operating at low power, with five separate safety systems disabled or disconnected and all but five of the control rods withdrawn. When the experiment caused an unexpected power surge, the emergency shut-down button was pressed, sending 211 control rods into the core. Within four seconds, steam pressure and power readings went off the scale; the zirconium fuel assemblies and the channels containing them disintegrated. And at 1.23.58, the reactor was torn apart by the first of several catastrophic hydrogen explosions: the 500-tonne *pyatachok* was hurled into the air, exposing the core. At his post in the main circulating pump room, machinist Valeri Khodemchuk was the first to die. His body has never been found.

At 45, Alexander Yuvchenko is still a big man, his 6ft5in frame almost filling the tiny lift that takes us to his ninth-floor flat on Moscow's Vernadsky Prospekt. These days, he doesn't much like talking about what happened: 'I don't advertise the fact that I was there,' he says. 'We've lived in this apartment for 11 years, and none of my neighbours know.'

As he begins to speak, rivulets of sweat run through his close-cropped hair; the blue handkerchief he kneads is soon soaking wet.

Yuvchenko was in his office on Level 12.5, halfway between the third and fourth reactors, when the blast came. It buckled the metre-thick walls, the door blew in and the lights went out:



he thought that war had finally broken out with the West. A powerful shockwave followed, bringing with it a cloud of choking milky grey dust carrying radioactive isotopes of iodine, caesium, strontium and plutonium. From outside came the hissing of escaping steam; leaving his office with a stretcher, he found one of the pump operators, badly burnt, filthy, wet and shivering with shock, who told Yuvchenko to rescue Valeri Khodemchuk. But when he looked up toward the place where the machinist was supposed to be, he saw nothing but empty space. Together with foreman Yuri Tregub, Yuvchenko ran outside to see what had happened; standing in the road beside the plant a little more than a minute after the explosion, the two men were the first to begin to comprehend what had happened to Reactor No 4: 'Half the building had gone,' he says now. 'There was nothing we could do.'

It was an apocalyptic sight: flames shot into the sky; sparks showered from the severed 6,000-volt cables hanging from the smashed circulation pumps; burst water and nitrogen tanks dangled in the air above the red-hot wreckage of the reactor hall; and from the centre of the building, an unearthly, delicate, blue-white light shot upwards into the night – a shaft of ionising radiation from the exposed core. 'I remember thinking how beautiful it was,' Yuvchenko says.

Momentarily transfixed by the eerie glow – known as Cherenkov's Light – Yuvchenko was dragged away by Tregub, who realised they were standing in a lethal field of gamma radiation.

Inside, Yuvchenko met Valeri Perevozchenko and two junior technicians sent to lower the apparently jammed control rods into the core by hand. But, as Yuvchenko explained to them, 'there were no control rods left'. Nonetheless, the four men climbed a stairwell to Level 35 to survey the damage from a ledge 114ft up.

Reactor No 4, a month after the explosion. Had the three remaining reactors been destroyed, the nuclear blast could have rendered Ukraine, Belarus and Russia uninhabitable for decades to come

Yuvchenko wedged his body against the massive steel and concrete door into the reactor hall to keep it open, while Perevozchenko and the technicians inched on to a ledge to search for the control rod mechanism. 'If the door had closed, they would have been buried there,' says Yuvchenko.

Perevozchenko held out a torch, and the three men gazed with horror into the blazing maw of the ruined reactor: they realised their mission to lower the control rods was absurd. They remained on the ledge for only as long as Yuvchenko held the door: a single minute. But by that time it was too late; all three had received a fatal dose of radiation. 'They were the first to die,' Yuvchenko says, 'in the Moscow hospital.'

Just after 1.25am, as flames leapt 600ft into the air around the reactor hall, the alarm sounded at Fire Station No 2 of the Chernobyl plant. In the telephone room, the 6ft-square status board, with its hundreds of red lamps – one for every room in the entire complex – suddenly lit up from top to bottom.

On the night crew was fireman Anatoli Zakharov, who had been stationed at Chernobyl since May 1980. It had been an uneventful six years, but Zakharov had seen Reactor No 4 being built, from the inside out. So when he parked his fire engine beside the burning wreckage of the building, and saw the chunks of graphite scattered across the asphalt, he knew there was only one place it could have come from.

'I remember joking to the others, "There must be an incredible amount of radiation here. We'll be lucky if we're all still alive in the morning."'

Zakharov is 53 now: a short, tubby man who welcomes me cheerfully into his flat on the 16th floor of a forbidding Soviet-era tower block in the Kiev suburb of Vystavka. He wears gold-framed spectacles and slippers, on each of which is embroidered a cartoon hand clenched into a jaunty thumbs-up sign. He tells me that of his shift of 28 men who went out to fight the fire that night, only 16 are still alive.

The hot debris from the exploding reactor set light to the bitumen-covered roofs of the ▶

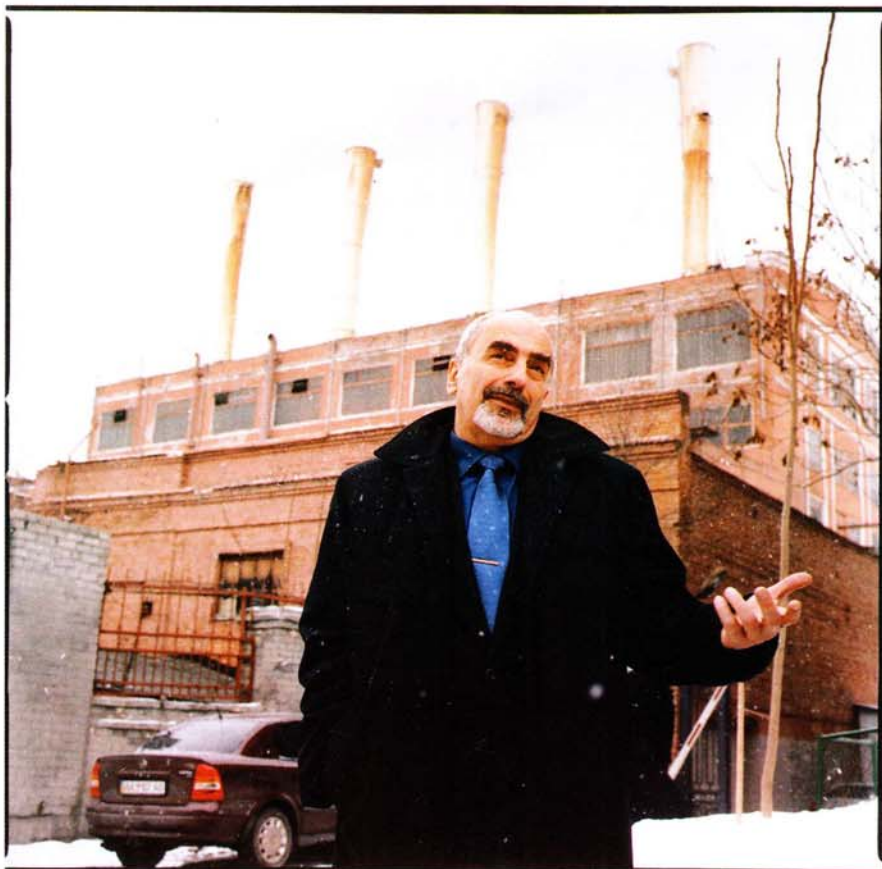
◀ surrounding buildings, threatening to spread the blaze into the kilometre-long turbine hall, and – even more catastrophically – to neighbouring Reactor No 3. While Zakharov remained with his engine on the ground, his commander, Lieutenant Pravik, took officers Titenok, Ignatenko and the others and climbed a ladder to the roof to fight the fire. It was the last time Zakharov ever saw them. They had no protective clothing, or dosimetric equipment to measure radiation levels; the blazing radioactive debris fused with the molten bitumen, and when they had put the fires out with water from their hoses, they picked up chunks of it in their hands and kicked it away with their feet. When the fires on the roof were under control, Pravik and men summoned from the Pripjat brigade climbed into the ruins of the reactor hall to train hoses on the glowing crater of the core itself, where the graphite was burning at temperatures of more than 2,000°C. This heroic but utterly futile action took them closer to a lethal source of radiation than even the victims of Hiroshima – where the bomb emitted gamma rays for only the instant it was detonated, 2,500ft above the ground.

A fatal dose of radiation is estimated at around 400REM – which would be absorbed by anyone whose body is exposed to a field of 400 roentgen for 60 minutes. On the roof of the turbine hall, both gamma and neutron radiation was being emitted by the lumps of uranium fuel and graphite at a rate of 20,000 roentgen an hour; around the core, levels reached 30,000 roentgen an hour: here, a man would absorb a fatal dose in just 48 seconds. It was a full hour before Pravik and his men, dizzy and vomiting, were relieved and rushed away by ambulance. When they died two weeks later in Hospital No 6, Zakharov heard that the radiation had been so intense the colour of Vladimir Pravik's eyes had turned from brown to blue; Nikolai Titenok sustained such severe internal radiation burns there were blisters on his heart. Their bodies were so radioactive they were buried in coffins made of lead, the lids welded shut.

Anatoli Zakharov remained on duty at the power station until 2pm, and then cycled home. He drank three litres of apple juice, and went to bed. Shortly afterwards, he was hospitalised in Kiev, where he remained for two months; they told him that he'd absorbed 300REM of radiation. 'That's what they wrote down. But only God really knows what my dose was.' In 1986, he was awarded the Order of the Red Star for bravery; in 1992, he was declared a total invalid. Now, he says the men from Fire Station No 2 never doubted the risks they were taking.

'Of course we knew!' he laughs. 'If we'd followed regulations, we would never have gone near the reactor. But it was a moral obligation – our duty. We were like kamikaze.'

During the early hours of 26 April, 37 fire crews – 186 firemen and 81 engines – were summoned to Chernobyl from all over the Kiev region. By 6.35am they had extinguished all the visible fires around the buildings of Reactor



No 4. The deputy fire chief of Kiev reported that the emergency was over; and yet, from around the displaced disc of the pyatachok came an ominous red glow. Reactor No 4 was gone; in its place was a radioactive volcano of molten uranium fuel and burning graphite – a blaze that would prove all but impossible to extinguish.

Sergei Volodin arrives to meet me for coffee in the lobby of Kiev's Hotel Rus wearing the full dress uniform of a colonel in the Ukrainian Air Force. This is the first time he's ever worn it; he had to make the holes in the tunic for his medals especially for today. Gentle and avuncular, he brings newspaper cuttings, and pictures of himself and his two-man crew taken years ago by *Soviet Union* magazine. 'There were rumours that we were all dead,' he explains, 'so they took pictures to show we were still alive.' He speaks quickly, eager to impart as much of his story as he can; but when he stops and reaches for his tea, his hands tremble.

Volodin began flying helicopters from the Soviet Air Force base in Kiev in 1976. It was a quiet posting; he spent the years flying bureaucrats and generals around the country in an Mi-8 helicopter specially equipped with lounge chairs, toilet and a bar. Once in a while, he'd pass

Nikolai Steinberg was charged with containing the fall-out and set 600,000 'liquidators' to work. They stripped the leaves from every bush and tree in Kiev and buried 70 villages in their entirety

the Chernobyl plant and, just out of curiosity, turn on the dosimeter that measured radiation inside the cockpit; there was never a flicker.

On the night of 25 April 1986, Captain Volodin and his crew had the emergency rescue shift for the Kiev area. Their helicopter was the first on the scene at Chernobyl. As the government assembled an emergency commission to tackle the disaster, Volodin was instructed to fly around Pripjat with an army major on board to take dosimeter readings; they would use these to map the radioactivity around the town. They set off without protective clothing, dressed only in shirtsleeves; it was another clear, cloudless day. But as Volodin flew toward the plume of smoke and steam rising from Reactor No 4, strange-looking, viscous droplets of liquid began beading on the canopy. Below, he could see a village where people were at work in their gardens; when he looked up at the dosimeter, the reading had gone off the scale. He flicked the device through all its settings – 10, 100, 250, up to 500 roentgen per hour: 'Above 500, the equipment – and human beings – aren't supposed to work.' Yet each time the needle ran off the end of the dial. Suddenly the major burst into the cockpit with his own dosimeter, screaming at Volodin, 'You murderer! You've killed us all!'

'We'd taken such a high dose,' the pilot says now, 'he thought we were already dead.' Later, Volodin discovered that the plume he had flown through was emitting 1,500 roentgen an hour. ▶

◀ Having established radiation readings for the map, the pilot then flew technicians from the plant around the reactor, to assess the damage; a photographer shot pictures of the destruction through the open window of the helicopter. Afterwards, Volodin was told he and his crew had been so irradiated they could no longer fly. Hospitalised in a Kiev cardiology ward, the doctors told him to drink as much wine and vodka as he liked; they had no idea how to treat him. Volodin stayed until late May, and returned to fly in and out of the disaster site for another five months.

Volodin retired as a pilot in 1991 to take a desk job. 'I have a strange illness,' he says. 'I'm afraid of flying.' Now 58, he has heart problems; his flight engineer is an invalid. In recognition of his work at Chernobyl, he receives a special liquidators' pension of 26 Ukrainian Hryvna a year. He points sadly at the drinks in front of him: 'The tea costs 35.'

On the morning of 26 April, as Pripjat hospital began filling up with casualties, there was still no official announcement about the accident. That Saturday began as usual: children went to school, a wedding was celebrated on the banks of the broad river, and sunbathers took advantage of the warm weather. But the ground beneath the path of the plume issuing from the reactor had been scattered with nuclear particles which emitted a field of up to 10,000 roentgen per hour; the air was filled with the entire range of radioactive isotopes. Throughout the day, station director Viktor Brukhanov refused to sanction an evacuation of Pripjat, insisting to the authorities that the radiation in the town was normal.

But when the chief of the plant's training programmes, Veniamin Prianichnikov, returned home that morning from a business trip to Lvov, he saw the streets being washed down with decontaminants. 'I knew something was happening,' he says. When he got back to his flat, he discovered that the phone had been cut off and his wife was out of town at their *dacha*, tending her flowers, directly in the path of the plume. She refused to believe anything was wrong – even when he showed her the specks of graphite on the petals of her wild strawberry plants.

Prianichnikov has been a nuclear physicist for more than 40 years, and has worked everywhere from the plutonium factory at Krasnoyarsk-26 to the atomic testing grounds of Kazakhstan. We meet on a freezing night in a deserted bar near his flat in the suburbs of Kiev. At 62, he's a thick-set, sardonic man with a patient, knowing gaze; he brings with him paper and a pen, in case he needs to draw me diagrams. Prianichnikov has already undergone one heart operation he ascribes to the accident; his experience has left him under no illusions about the realities of living in the Soviet state. He says he always tried to steer clear of the Communist Party: 'I never liked them that much. They killed my father, they killed my grandfather, many of my relatives. Is that not enough?'

From the outset, Prianichnikov suspected the accident was catastrophic, but without a dosime-



ter he found it hard to convince his neighbours of such a heretical idea: 'People wouldn't believe me – and they could give you eight years in prison for going around saying things like that.' When he finally got through to his boss at the station, he was told that an exercise was being conducted. But by the time the sunbathers had been hospitalised with nausea and vomiting, Prianichnikov had shut his wife and daughter indoors, and had them packed and ready to leave. That night, from the sixth-floor balcony of the flat, they watched yellow and green flames flare from the torn ruins of Reactor No 4.

On Sunday the 27th, Pripjat was finally evacuated. The population went quickly and calmly under the eyes of the militia, but were forced to leave their pets behind. Their coats hopelessly irradiated, many dogs ran after the buses as far as they could, but eventually fell back to the town, where they began to turn feral. A group of local hunters with shotguns was sent in to shoot the animals. By 29 April, the streets of Pripjat were littered with their radioactive corpses.

The graphite in Reactor No 4 had been burning for almost 24 hours when the Chernobyl Commission decided the only way to extinguish the fire was to smother it. The scientists suggested

The Monument to the Liquidators commemorates the heroism of those brought in to clear up. It's estimated 4,000 will eventually die due to their contamination

sand, boron and lead, to absorb radiation and cool the melting core – 4,000 tons would do it, dropped into the blazing reactor from the air. On the afternoon of the 27th, two Mi-8 helicopters from Kiev began the first of hundreds of fire-fighting sorties. The pilots navigated through a forest of pylons surrounding the power station to hover 100 metres above the burning building, and, aiming by eye, dropped individual bags of sand from the helicopters' open doors. The radiation directly over the reactor was such that the pilots soon began being sick in the air; eventually they started flying in respirators, and sliding lead panels under their seats. By 1 May, they had dropped 4,450 tons of sand into the reactor.

But on 2 May, the engineers and physicists at Chernobyl made a horrifying discovery: the temperature of the core and the volume of radionuclides rising from it were both increasing. They suspected that the whole helicopter operation had been a terrible mistake: the sheer weight of everything they had dropped on the reactor from the air – including 2,400 tons of lead – had not only caused structural damage but was pressing the hot reactor core against its concrete base. And if the uranium reached meltdown temperature – 2,900°C – a single sphere of molten fuel would burn through the concrete foundations of the reactor building, and keep going until it reached the water table. At that moment, there would be another explosion, exponentially more devastating than the first; the three remaining ▶

◀ reactors would be destroyed in a nuclear blast that would render Ukraine, Belarus and Russia uninhabitable for decades to come.

'That was the most terrifying thing,' says Veniamin Prianichnikov. 'We were petrified of meltdown, walking around like zombies.'

A plan was devised: to freeze the earth around the reactor with liquid nitrogen, and then build a heat exchanger in the ground beneath it to cool the core and prevent meltdown. Prianichnikov himself was sent in with temperature and radiation probes to discover how long they had before the core burned through the two metres of concrete foundations; meanwhile, miners were summoned from the coalfaces of Donetsk and the subway projects in Kiev to dig tunnels beneath the reactor. The scientists feared that pneumatic drills could disturb the foundations of the reactor, so they worked with hand tools, in conditions where wearing protective clothing was practically impossible, amid extraordinary fields of radioactivity. To freeze the ground, all the liquid nitrogen in the western Soviet Union was sent to Chernobyl: when it didn't arrive quickly enough, director Brukhanov received a late-night telephone call from the minister in charge of the operation. 'Find the nitrogen,' he was told, 'or you'll be shot.'

On 10 May, the fire finally subsided; it now seems possible that the graphite simply burnt itself out. The nitrogen was found, and the sub-

terranean heat exchanger built, but by mid-May the temperature of the core had dropped to 270C; the exchanger was never even turned on. 'The miners died for nothing,' says Prianichnikov. 'Everything we did was a waste of time.'

When I ask him if he received any recognition for what he did, Prianichnikov smiles darkly. 'I didn't go to court, and I wasn't put in prison. That was the recognition I received.'

In the weeks following 26 April, hundreds of thousands of scientists, soldiers and civilian workers were sent by train to Chernobyl from every republic of the USSR. They camped in settlements and tents in the newly established 30km exclusion zone, or were billeted on Black Sea cruise ships moored on the River Pripjat.

After the decimation of the station management by the accident, Nikolai Steinberg was appointed technical director of the plant. He was charged with containing the wreckage of Reactor No 4, protecting the population of Ukraine and Belarus from the contamination spread across the landscape, and restarting the three remaining reactors of the station, shut down in the immediate aftermath of the accident.

Steinberg worked from an office with lead plates covering the windows and developed an instinct for sensing radiation: when he encountered a field in excess of 135 roentgen an hour, he says he could feel it 'like a punch in the eye'.

Now Ukraine's deputy minister for nuclear energy, Steinberg is wry and charming, but deploys the careful evasiveness of a practised politician. He speaks in a dry whisper, a result of throat cancer diagnosed in 1996; but he refuses to connect it with Chernobyl: 'It happened – but I smoked for 25 years. I'm still alive.'

During May and June 1986, the 600,000 liquidators were set to work: soldiers were sent to Kiev to cut the leaves from every bush and tree in the city and bury them; helicopter crews sprayed a special polymer film from the air to capture radioactive particles on the ground; the Pripjat was dammed to prevent irradiated water flowing into the Dnieper; 135,000 people were evacuated from the exclusion zone; 70 villages were so contaminated that they were flattened and buried in their entirety.

To collect pieces of fuel and graphite from the roofs around Reactor No 4, three lightweight robots were bought in Germany for one million gold roubles. But up on the roofs, the machines were useless: their electronics failed in the intense fields of radioactivity; they got bogged down in the melted bitumen and became entangled in abandoned fire hoses. 'The best robots,' Steinberg explains bitterly, 'were people.'

So, 3,400 army reservists with picks and shovels were sent to clear the roofs. The men were given strict time limits – 20 seconds, 25 seconds, two minutes – to limit their exposure,

and makeshift lead clothing made from metal torn from the walls of the plant. But little practical protection was possible: 'It could reduce radiation by two or perhaps three times, but it wasn't enough,' Steinberg says. 'The dose was immense.'

Although they were volunteers – two minutes on the roof was said to count for two years of military service – few had any real understanding of the risks they were taking. One soldier later described a friend climbing the tower overlooking Reactor No 4 to hoist a flag, 'to symbolise man's power to conquer radiation'. Sometime afterwards, the soldier became paralysed.

With the clean-up complete, the Sarcophagus – the huge prefabricated steel and concrete shell built to contain the ruins of Reactor No 4 – was put together by cranes; a six metre-thick wall protected the builders from gamma radiation. It took five months. On 1 October 1986, the turbines of Reactor No 1 at Chernobyl came back online; No 2 and No 3 followed soon afterwards.

When I ask Nikolai Steinberg what dose of radiation he received, he smiles. 'Enough. It can't be measured. I can only guess.' And then, from his desk drawer, he produces a photograph of a small child with dark hair. It is his three-year-old son; Steinberg will be 59 in June. 'So,' he says, 'I suppose I must be OK.'

In Moscow, Yuvchenko is still recovering from the single minute he spent holding open the door for his friends in the early hours of 26 April

1986. That night, when they put him on the plane to Hospital No 6, he thought he would be in the Moscow clinic for a few days. 'It turned out to take a year,' he says. 'And the rest of my life.'

The door into the reactor hall had been covered with radioactive dust; Yuvchenko's clothes were soaking wet from steam and escaping cooling water. Where his left shoulder, hip and calf touched the door, he suffered terrible beta and gamma radiation burns. His skin turned black and sloughed off; his left arm was in bandages for seven years. Today his arms and back are scarred violet-red with the results of skin grafting operations so numerous he stopped counting at 15. He doesn't know if the radiation made him infertile, but he and his wife Natalia were advised not to try to have any more children, as a result of possible DNA damage. He still has two weeks of check-ups every year.

Yuvchenko returned to work in 1989, taking a job at the Moscow Research Institute of Theoretical and Experimental Physics. This year, his son Kirill will turn 23; he's currently in his sixth year of medical school in Moscow. 'He's so good,' says Natalia, 'that I think he's a reward for everything that's happened to us.'

The total number of deaths caused by the explosion of Reactor No 4 remains the subject of fierce debate; early predictions of hundreds of thousands of fatalities have apparently proved unfounded. Last year, a WHO and International

Atomic Energy Authority-backed report estimated that of the 600,000 people across the Soviet Union exposed to high levels of radiation by the accident, 4,000 would eventually die.

Alexander and Natalia Yuvchenko say that the effects the radiation has had on their health aren't as bad as people think. 'The doctors keep telling me I've survived – so I can carry on now without worrying,' says Alexander. 'But when I went back to Ukraine, they started telling me about people who had died. But was it due to radiation? I don't know. I don't understand anything about statistics. But when my friends ask me about it, I tell them: the less you think about it, the longer you'll live.'

Back in the deserted town of Chernobyl, near the war memorial, opposite the tombs of the Heroes of the Soviet Union who fell recapturing the town from the Germans in 1944, is a heavy concrete monolith inscribed with neat rows of names. At first glance it looks like any other memorial to men long-dead and half-forgotten. But this one is slightly different; it commemorates those killed by the explosion at the Chernobyl nuclear power plant: above an inscription are three polished steel plates filled with the dozens of names of those who had died by 1996; beside that are 200 names added in 2001. And beside these, at the far end of the monument, the builders have left a long, empty space: for the deaths yet to come. ★