

## In the line of fire

Russia's intelligence services don't like people who investigate nuclear pollution. This makes *Sergei Pashenko's* job – radiation researcher and campaigner – highly risky. His discovery that contamination in Russia is far worse than official reports admit is hugely controversial, especially as the government hopes to earn millions of dollars by importing nuclear waste. *Paul Webster* talks to one of Russia's bravest scientists

### How often have you been arrested?

Many times. Sometimes we just sit around and have a few beers, and the officers tell me their problems. They aren't always very professional. Frankly I have some sympathy for them. I'd like to see them do a better job. I have also met with some of the more senior FSB [Federal Security Branch, the Russian security and intelligence service] colonels here. It looks like they are undergoing a major change. They seem to be deciding which way to go. The extremists are in retreat, but they still want a strong Russia and a strong FSB. They oppose disarmament. They are counting heavily on President Putin. Certainly, Putin has hugely reduced environmental regulation and monitoring in Russia, which has had a deadly impact on environmental science. If they decide they want to go back to an authoritarian state, they could do it quickly.

### Which nuclear sites have you been investigating?

They are in areas near plants operated by the Russian Ministry of Atomic Energy [Minatom] and possibly the Ministry of Defence, at Novosibirsk, at Chelyabinsk in western Siberia, at Tomsk, and at Karsnoyarsk in the east. They include nuclear power stations, reactor fuel factories, and plants where nuclear waste and used fuel is reprocessed and stored.

### Are they all civilian installations?

They are all civilian, though some may be military as well. It is illegal to ask questions about military sites, so we stay away from them. But because we don't always know which sites are civilian and which are military, or if they are both, there is always the risk that we will be arrested for investigating pollution from

what we did not realise was a military facility. That's a big worry for us, because if we're arrested for researching pollution from a military facility, we could be charged with spying on it. Other scientists charged with spying have spent years in jail even before their cases are tried. The trials are usually secret, and proving your innocence is horribly difficult. We stay out of closed areas. But even in open areas, we frequently find enormous levels of radiation.

### What have you found?

We've established that Siberian radiation pollution is far greater than Minatom admits. Over and over again our field results from many sites haven't matched Minatom's figures. A major problem is trying to distinguish between historical and present-day pollution. When the nuclear officials say the pollution is historical, we can find out what's going on by tracking the radioactive isotopes and matching them with their decay patterns.

### Can you give me an example of something you've uncovered?

My most dramatic discovery was in 2000, when I was working with a group of US researchers called the Government Accountability Project (GAP), who started out investigating nuclear pollution in the US and now work with whistle-blowers worldwide. I met them at a conference in Siberia in 1999. We found very alarming levels of radiation near Tomsk, where there is a plutonium-producing reactor which, although it may possibly have an undisclosed secret military purpose, is used to generate electricity. We found extremely high radiation levels in the Tom River downstream from the reactor, including traces of plutonium. There was an explosion at the plant in

**Sergei Pashenko is a nuclear physicist at the Russian Academy of Sciences' Institute of Chemical Kinetics and Combustion in Akademgorodok, Siberia. He also lectures in aerosol pollution and ecology at Novosibirsk State University. He says he loves Russia and respects authority, but his work frequently gets him in trouble with the police. Suspicion of environmentalists is growing in Russia, and Pashenko is increasingly treated as a political dissident**





1993 but many of the isotopes we found were too young to derive from any historical accident.

The Tom joins another river which runs into the Arctic Ocean and we think the pollution levels are high enough to pose an extensive threat to the ocean. Our study suggested that the plant is the world's largest radiological polluter and a considerable risk to local health. We tested the samples in local laboratories, but unfortunately the duplicate samples we sent to a laboratory in Canada for verification took so long to get there that the results for many of the short-lived isotopes were meaningless.

#### What was the official reaction?

The FSB arrested me while we were doing the field research for the study near Tomsk. They questioned me for a day, then let me go. The fact that there were many foreigners watching helped. The FSB reminded me of the risks of investigating a facility that could have a military use. They did not challenge our right to take samples from the river. But they thoroughly examined all of our equipment and confiscated my GPS locator, which we use to plot the exact location of the field samples. They were most interested in the GPS gear. One of the older officers seemed to think we were using it to send signals to the Pentagon. After six months, the GPS was returned with no explanation other than it needed to be registered. So we did that.

#### How has Minatom reacted?

Minatom rejected our results for the Tom River study, claiming all emissions were within regulatory limits. But in doing so, they have for the first time provided their own data about pollution in the river. And interestingly, they are admitting there are some very worrying radioactive compounds in the river bed including neptunium, which is a plutonium decay product. I think they may have revealed that to us because they thought we would figure it out. So in a way, they have opened the door for further research.

Minatom has invited me to work with them at other sites. Starting in 1995, we conducted a study of wind-borne radioactive compounds here in Novosibirsk with their permission. They were surprisingly positive about a study we did at Chelyabinsk, and have said they want to work with us there as well. They can see we aren't green anarchists who



want to close everything down. They appreciate our expertise with airborne radiation dispersal. It could be a very interesting time, although the FSB in recent months have cast a shadow on that.

#### How is your institute taking this?

Probably because the FSB have repeatedly called me in for questioning and visited the director of my institute about me more than once, my radiation pollution research has caused a lot of friction there. Although my other work – aerosol physics – is approved, I've had trouble with the institute over this research for years. So I am currently forbidden to conduct radiation research there. The results could be politically dangerous and our academics are very afraid.

#### How does your work affect your day-to-day life?

I have an arrangement with the director of my institute that allows me to use my two-room apartment in Akademgorodok as a laboratory. This can create problems for my wife and daughter. And our cat, which once ate a set of samples.

#### What are you working on now?

My hope was that this spring we would receive a photon spectrometer from GAP in the US to allow us to verify our results from the Tom River study in 2000, and to do more sophisticated studies at other sites. But over the winter

**"The only support I get for my environmental research work comes from outside Russia"**

the FSB have interfered with that hope. In February, three police officers questioned me at my apartment in front of my nine-year-old daughter for two hours. It was all about the GPS, which they confiscated again. As a result of the FSB visit and the charges I am facing, my US colleagues have decided not to try to bring the photon spectrometer to Russia this year. They think it will wind up as another gift for the FSB. But I am going back to the Tom River this summer to try to replicate our earlier results.

#### What have you been charged with?

I have been charged under a law forbidding certain kinds of measurements of secret places. Those places are listed on a secret list, which I haven't seen and neither has the judge. So we don't know which site we are being accused of illegally locating. From a scientific viewpoint it's all nonsense. You can buy a GPS anywhere now in Russia. From a legal viewpoint we think it is equally idiotic. The GPS is registered with the FSB. The sites we investigate are open to the public. Usually there are people fishing and collecting berries and mushrooms nearby, despite the radiation we often find.

#### Why are they so suspicious now?

There has been increasing suspicion

against environmental researchers in Russia following the 11 September terrorist attacks. Maybe that's why this has happened now. Minatom is aware we planned to go back to the Tom River. A lot of people say that environmentalists are being targeted as political dissidents. There have been a number of high-profile cases where radiation researchers have been charged with spying in recent years. Here in Novosibirsk, the local FSB won an award for arresting a US researcher, Edward Pope. He went to jail and President Putin released him on humanitarian grounds because he had cancer.

**How important is it for you to work with foreign researchers?**

The only support I get for my environmental research work comes from outside Russia, since the contracts we have here won't buy the expensive equipment we need. My salary at the institute is about \$100 a month. Getting foreign assistance for equipment is crucial to our scientific independence, although working with foreigners can attract trouble, because the nuclear industry is competing for foreign nuclear contracts and tends to see foreigners as hostile agents.

**Do you consider yourself an environmental campaigner as much as a researcher?**

Yes. Very explicitly.

**Are you against nuclear power or simply against dirty nuclear power?**

I support a phase out of nuclear power under a tightly controlled safety regime, and its replacement by clean renewables.



**How did you become interested in radiation?**

My parents were geologists in a uranium mine in Chemnitz on what was the border between Czechoslovakia and East Germany, where I was born in 1953. My mother carried me underground in the mine until weeks before she was due. Maybe that's where I became fascinated with radiation. After I was born, we moved to a uranium smelting town in Kyrgyzstan. It was a secret place, totally fenced off from the outside world. When we moved there, the fields were full of red poppies. By the time I graduated from school the poppies didn't grow any more. I didn't learn what my parents actually did until much later, after glasnost loosened Soviet atomic secrecy in the late 1980s. By that time I was a nuclear physicist. So I think you could say radiation is something of a family business.

**When did you first become concerned about radiation pollution?**

I started to get active on this around 1995, when I learned that the Chemical Combine plant in Novosibirsk was actually a nuclear fuel fabrication centre. I had no idea, even though I had lived in Novosibirsk since 1975. I found out because the plant asked me to do a five-year study of airborne pollution for them. We found the area around the plant was quite clean, but further downwind there was a substantial radiation problem. Hundreds of people who lived there received doses big enough to sue over.

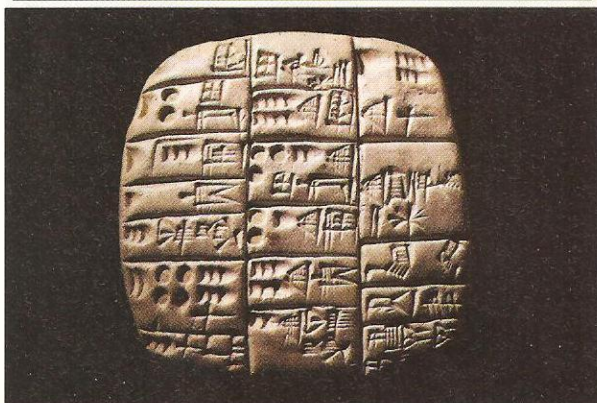
**How easy was it to investigate radiation pollution in the Soviet era?**

My research in Soviet days was almost entirely theoretical. We did very little field research, and we never got near the nuclear sites. Working in Siberia, where there is a whole chain of atomic cities, should have given me broad scope, but secrecy prevented me from even raising the topic with my students.

**When did things start to change?**

The Chernobyl disaster in 1986 really opened the discussion, though people only began openly talking about the scale of radioactive pollution in the Siberian wilderness around 1993. My first studies based on field research were published in 1996. Since then, a growing number of Russian journals have been willing to risk violating secrecy laws by publishing our work. Now, doing research is increasingly a matter of human relations. ●

**GRAPEVINE  
ERIDUG**



Probably not a place you'll have heard of unless you are a scholar of ancient Mesopotamia. But all those dodgy accountants fleeing from the Enron and Worldcom scandals might find solace there. For study of Eridug shows that we owe a big debt even to dodgy accountants. Without fraud – and strenuous efforts to avoid it – we would never have had writing at all.

Travel back 10,000 years to the fertile crescent of Mesopotamia in present-day Iraq. Its alluvial plains were the birthplace of agriculture, creating a settled population ruled by the kings of Eridug. As agriculture boomed, so the first means for recording trade and taxes appeared. Archaeologists have found thousands of small clay tokens in the shape of cylinders, cones, spheres, even models of animals and tools from the area. Each token probably stood for a particular product: an egg shape represented a jar of olive oil and a cylinder a sheep.

But how do you stop someone just heading for the nearest clay pit and rolling out a few hundred egg shapes without even cultivating an olive tree? One solution was to store the tokens in secure places, such as palaces or temples. That's where archaeologists

find them today.

But there was clearly pressure from fraudsters. By 6000 BC, the Mesopotamians were stringing the tokens together then marking each string with a lump of clay impressed with a personal seal. The seal shows who was in on the deal. Changing the tokens would break the seal, revealing tampering.

After the Mesopotamians came the Sumerians. One of their accountants invented something even better – the clay envelope. It could be filled with tokens, pinched shut, and then marked with seals, making it tamper-proof. But that created a problem of what was inside the envelope: you had to break it open to know the exact deal. So details were marked on the outside too, first by pressing the tokens into the envelope's surface.

From fraud protection it was a short step to writing. Some of the tokens were so elaborate they could not create a good impression on the clay envelope, so accountants drew pictures of them instead. Laziness led to simpler shapes to represent the elaborate tokens, then to a full syllabic alphabet.

Writing truly took off much later. But in ancient Sumer, accountants and tax collectors clearly ruled the world – perhaps they still do.