An Investigation into the Death of a Nuclear Safeguards Inspector Vienna, Austria, February 1978

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"Could he have been electrocuted?"

In early February 1978 I finished work for the day at the International Atomic Energy Agency (IAEA) in Vienna, Austria. I closed my office door behind me, nodded at the armed guard as I made my way through the IAEA lobby, and stepped outside into the throng of pedestrians bundled up in winter coats. Strassenbahns zipped by in both directions along the Ringstrasse, and across the street was the grand and imposing Hotel Imperial where my wife and I, along with our three young daughters, had watched the Spanish royal family emerge during a diplomatic visit.[1] I was a long way from the small town in northern New Mexico where I'd worked at the Los Alamos National Laboratory (LANL) prior to my one-year appointment in the Department of Safeguards at the IAEA. But my family's life in Vienna had quickly become the new normal, and on that February evening I headed toward the Karlsplatz station to catch the Stadtbahn home.

On the street I ran into a colleague, Uldis Barda (Australia), one of the IAEA's safeguards inspectors. I'd known Barda for about six months, and we'd developed a good working relationship. He told me some sad news: he'd just received word that a fellow safeguards inspector we both knew, Pierre Noir (France), had died of an apparent heart attack during an inspection of the Taiwan Research Reactor. Noir had been installing a video surveillance system in the reactor building at the time. He was the first IAEA inspector to die on the job.

After a thoughtful pause, Barda asked, *"Could he have been electrocuted?"*

This question was deeper and more fraught than it seemed. During my time at the IAEA, I'd become aware of an underlying fear that all inspectors had: what would happen to them if they uncovered evidence that a facility was diverting nuclear material? Would they be in danger because of what they knew? Should they say anything to anyone at the facility about what they had learned? Or should they stay silent—and quickly leave the country?

The death of a safeguards inspector while on an inspection at a nuclear facility is every inspector's worst fear. When Barda asked me that question about Noir's death, he was not only wondering if Noir had died by accidental electrocution, he was also wondering *if Noir could have been intentionally killed because he had discovered a problem at the facility.*

[1] The IAEA was originally located in central Vienna before moving north of the Danube to the Vienna International Center after it was completed in 1979.

U. S. Assistance to the IAEA

The IAEA is the branch of the United Nations responsible for verifying that signatory countries to the 1970 Nuclear Non-Proliferation Treaty (NPT) are abiding by the treaty's terms. In exchange for receiving help with peaceful nuclear activities, these countries agree to allow inspectors into their nuclear facilities to verify that their nuclear activities are not being used for clandestine nuclear weapons development. Safeguards inspectors monitor nuclear materials and processes at the facilities to verify adherence to the NPT.

At the time of my conversation with Barda, I was a 37-year-old physicist/nuclear engineer. I'd worked at LANL since receiving my Ph.D. in Nuclear Engineering from the University of Arizona in June 1969. My technical expertise was in developing non-destructive assay (NDA) techniques and instruments for measurements of materials used in nuclear weapons, highly enriched uranium and plutonium.

This expertise was the reason that I had been offered the opportunity to work at the IAEA. Over time, the U.S. Department of Energy and the U.S. Department of State had become concerned that the technical expertise at the IAEA was not good enough to ensure adequate verification so they established a special Program of Technical Assistance (POTAS), administered by Brookhaven National Laboratory. One of their programs was to send "cost-free experts" to the IAEA to help with development, deployment, support, and training on various nuclear measurement and surveillance techniques. I was one of the first of these cost-free experts.

But when I arrived in Vienna, my work assignment took an unexpected turn. As a result, when Barda approached me, I was uniquely prepared to investigate the circumstances of Noir's sudden death at the Taiwan facility.

Assignment Change

I'd arrived in Vienna in June 1977 and was still jetlagged when I reported for my first day of work. POTAS program coordinator Leon Green introduced me to Ed Kerr (Canada), who would be my boss for the year. Kerr had been at the IAEA for many years and was head of the Technical Support Section, which is responsible for helping inspectors, providing technical equipment, giving training on the use of equipment, etc.

Kerr took me to meet his boss, Adolph von Beckmann (Germany), head of the Department of Technical Development and Operations. Much to my surprise, von Beckmann assigned me to work on the new Closed-Circuit TV (CCTV) surveillance system, which he said needed more support. This assignment was quite a bit different than working with neutron assay techniques, which was what I had been recruited to work on.

A tone I noticed in this meeting, and in other meetings and encounters during the next few weeks, was the amount of distrust some individuals at the IAEA had of the POTAS program. There was an undercurrent of feeling that the U.S. already had too much influence over the operations of the IAEA and that the US cost-free experts were just another example of overreach. I had the suspicion I was assigned to work with the surveillance equipment specifically because I was not an expert in the area, and, thus, I probably wouldn't be able accomplish much. My suspicion was strengthened by the comment, "Since we don't pay you anything, we don't expect anything."

But as it turned out I had a wealth of practical experience in understanding and tracing electronic circuitry that would be critically important to understanding the cause of Noir's death. Thirty years earlier, in the 1940s, I started building and repaired radios as a hobby. I built my first radio—a crystal radio set—when I was seven years old in the second grade in 1947. A classmate had a crystal radio, and I was fascinated by it. I wanted one, so I decided to build one. I studied the crystal set, and with pencil and paper I drew a crude diagram of the parts and how the wires were connected.[2] I scrounged up the thin enameled-coated wire to wind the tuning coil. My mother bought me a set of headphones, and my dad helped me string a long-wire antenna from my bedroom window to a distant tree. And the little radio worked! I spent hours fiddling with it to improve reception, while listening to our local AM radio station, KMED, in Medford, Oregon. This radio was just the beginning of three decades of personal and professional interest and involvement in electronic circuitry.

CCTV

Over the next few weeks I familiarized myself with the CCTV surveillance system (Fig. 1.).[3] I set up a "TV lab" (a small room with two tables and a chair!) and filled it with several CCTV surveillance systems and video cameras, which had not yet been sent to facilities. I learned how to operate and test the systems, and I put the CCTV units through long "burn-in" tests—days to weeks—to make sure they operated reliably before they were shipped.

I also talked to many inspectors—including Barda, Noir, and Alberto Lumetti (Italy)—to learn of the concerns they had.

Some of their concerns had administrative solutions; for example, they complained bitterly that parts and tools, such as the take-up reels for the video recorders, were often missing when they went to install a unit in the field. This resulted in an enormous loss of time—sometimes weeks and months—before replacement parts could be obtained. The simple act of making sure that spare reels were included in the shipment was important. I developed a checklist of parts and tools, a simple step that made a huge difference in the success of an installation.

Other concerns involved the lack of help they got from the Technical Support Section, especially when they were faced with unusual verification situations.

I gained some valuable field experience of the challenges inspectors encounter when I participated in a verification exercise in November 1977, at the Beznau nuclear power station (which has two reactors) in Switzerland. The nuclear plant operators were going to move highly radioactive spent fuel assemblies (containing large quantities of plutonium) from the storage facility at one nuclear reactor to the storage facility at the nearby reactor. The IAEA needed to

[2] Today we call this kind of activity "reverse engineering."

[3] The Figures start on page 11.

monitor the transfer operation to verify that spent fuel traveled only from the first storage facility to the second facility, and not to somewhere else. The spent fuel assemblies would be transported in very large, heavy containers ("casks"), which shield personnel from the extremely radioactive fuel. A large crane would load the fuel cask onto a flatcar. A locomotive would then transport the cask the short distance to the second reactor, where another crane would unload it and move it into the second facility. Because of the size and weight of the casks, each transfer of spent fuel from one facility to the other would take several hours. The entire operation to transfer all the assemblies from the first facility to the second one would take several months.

The IAEA would monitor these transfers using time-lapse video recording. Normally, the inspector responsible for such a surveillance exercise would have taken care of the installation of the CCTV surveillance system, but in this exercise the cameras needed to be installed outdoors and the IAEA had never done an outdoor surveillance exercise before.

Lumetti, the inspector responsible for this exercise, asked me to adapt the cameras to work during the Switzerland winter. This exercise provided a good opportunity for me to help with an unusual inspection. Lumetti and I decided we would use heated, temperature-controlled camera enclosures to keep ice from freezing on the glass windows of the enclosures. I ordered two enclosures with heated windows (much like the video enclosures you see today in parking lots of "big box" stores) from a vendor in the United States and, fortunately, they arrived in Vienna in the nick of time, just a week before the fuel transfer operation was to begin. I had barely enough time to put the cameras/enclosures through a few days of tests—outdoors, on a ledge outside the window of my TV lab—before we shipped them to Switzerland.

I met Lumetti in Switzerland, and the installation went smoothly. The facility operators had installed the power and video cables prior to our arrival. We aimed one of the outdoor cameras towards the loading area of the first spent fuel storage facility and pointed the second camera, located some distance away, at the unloading area at the second facility. The views of the two cameras overlapped and we could monitor the entire transfer path.

Lumetti and I would return in February or March, after the fuel transfer operation had finished, to see how the system had worked and to review the videotape. As I left my hotel to catch a flight back to Vienna, I slipped on a thick layer of ice on the sidewalk, from the overnight freezing rain. Winter weather had arrived in Switzerland, and I crossed my fingers for those heated camera enclosures!

Investigation

The reason Barda had asked me if I thought Noir "could have been electrocuted" was because he knew I had been working with the CCTV system for several months; I probably knew more about it than anyone. By February 1978, my impression of the CCTV system was that it was functionally sound and, with more testing and minor improvements, it could probably be made into a reliable surveillance system. However, it was always going to be a difficult system to implement in the field because of its large size and the complexity of installing the remote video cameras in a facility. The CCTV system consists of a control unit, remote cameras, and connecting cables (Figs. 1, 2). The control unit is rather large, about the size of a dishwasher.

Three long coaxial (coax)[4] cables and the power cable need to be routed from the control unit to each remote camera (Fig. 2). The facility operator installs the cables, and the IAEA inspector sets up the video cameras and control unit. When the inspector is not present, the cabinet of the control unit is locked and sealed to prevent unauthorized access.

The control unit houses all the recording and control electronics. The reel-to-reel, time-lapse video recorder is located at the bottom of the cabinet, and the video monitor and control electronics are at the top. In the photo (Fig. 1), a video camera is sitting on top of the control unit, but in an actual installation the cameras are located far from the control unit.

The CCTV system can operate with one or two remote cameras, and the monitor has a split-screen feature which allows images from both cameras to be viewed and recorded simultaneously. The time-lapse recorder can record short video segments (e.g., 5 sec.) at various intervals of time (e.g., 5 min.). A built-in crystal-controlled clock superimposes the month, date, hour, minute and second on the recorded segments.

The remote cameras can be located as far as 500 meters from the control unit, and each camera is connected to the control unit via a 230-volt power cable and three long coax cables. The power cable plugs into the European-style power socket on the control panel near the video monitor (Figs. 1, 2).

It is important to note that even though the control unit can work with line voltage of 230 volts AC, 110 volt AC, and the built-in 24-volt battery, which keeps the system operating in case of power failure, the CCTV unit is fundamentally a European piece of equipment operating at 230 volts. When it is used in other countries—Canada, for example, has powerline voltage of 110 volts—the voltage is stepped up inside the control unit to 230 volts. The remote video cameras require 230 volts AC.

The three long coax cables running to the video camera are for the analog video signals and horizontal and vertical synchronization (sync) pulses. These coax cables plug into the 29-pin socket on the control unit via a "patch cable," which consists of three short (12"-18") coax cables with a matching 29-pin plug at one end and three coax connectors on the other (Figs. 2, 3).

This patch cable and the matching 29-pin socket on the control unit proved to be important in the investigation into Noir's death. To illustrate what the patch cable looked like, I've made a replica of it (Fig. 3). The 29-pin plug and matching socket in the photo are vintage connectors I purchased on the Internet, and they are nearly identical in shape and size to the actual ones. (Note: I made the coax cables of this replica shorter than the actual ones (12"-18" long) so they would fit into the photograph.)

At the time Barda and I spoke outside the IAEA on that February evening, I had no reason to suspect I would find a serious electrical safety problem with the CCTV system. Yet his question

[4] A coaxial (coax) cable is a two-wire line that consists of a central copper wire surrounded by a concentric shield of fine copper wires, separated by a flexible plastic insulating material. The shield protects the central wire from picking up electrical noise signals from the background. This shield is always connected to the electrical ground of the instrument. An example of coax cables used today are the Internet and TV cables that connect to our homes.

did pique my interest for several reasons. First, even though I knew a lot about how to operate and maintain the CCTV system, I knew very little about the electronic circuitry inside the control unit. Second, and more importantly, we had about 20 of these CCTV systems spread around the world; if there was a safety issue, I needed to find it and eliminate it.

On the morning after I talked with Barda, I went to see Yuri Konnov (USSR) of the Technical Development Section, who had overseen the development of the CCTV system with the Viennese company Psychotronic Elektronische Geräte. I asked him for a copy of the circuit (schematic) diagrams so I could begin to understand the electrical wiring—in particular the high-voltage circuitry—of the control unit. But Konnov didn't have the schematic diagrams, and he made it abundantly clear he was not interested in helping me get them. Next, I contacted the technical sales representative at Psychotronic, but he refused to give me them because they were "proprietary," and he wouldn't discuss it further. Both of them already knew of Noir's death but were unwilling to help discover the cause.

<u>Circuit Tracing</u>

It was clear I wouldn't get any help from people who had been involved in the development of the system, so I did the only thing I could: trace through the actual wiring myself and sketch what I learned with pencil and paper. As you might imagine, tracing circuits inside an unfamiliar electronic instrument is not easy; sometimes it seems like trying to follow the path of a single strand of spaghetti in a bowl full of pasta in a dimly lit restaurant! Components, connections, and wires can be difficult to find or even see because they are hidden behind other components or are in dark corners of the chassis. Occasionally, wires leave one electronics module and travel along hidden paths to distance modules elsewhere in the system.

But, as I mentioned earlier, I had a lot of experience with circuit tracing, including high voltage circuitry. I was ten years old when I built a radio that was powered from the power lines. I learned how to read schematic diagrams, wire up capacitors, resistors, coils, tube sockets, etc., and solder electrical connections. In high school I learned Morse code and got my amateur radio license (W7ETS), and I built much of my own equipment, often using parts I'd scavenged from junked radios. In those days, radio communication equipment—both receivers and transmitters—used vacuum tubes, which require high voltages (~100-400 volts), so I'd learned how to work safely with high-voltage electricity. One of the most crucial things I'd learned along the way was that electrical shocks from powerline voltages of 110 volts (in North America) and 230 volts (in Europe) can be lethal.

The obvious starting point in the search for an electrical safety problem in the CCTV system was with the wiring associated with the 230-volt sockets on the front panel of the control unit (Figs. 1, 2). These sockets supply the electrical power, via long power cords, to the remote video cameras. I traced these wires in one of the CCTV units I had in my TV lab but found no problems. Next, I wondered if there could be a wiring problem in a remote camera that could send high-voltage current back down the coax cables to a person working at the control unit. However, I found nothing unusual in the wiring of the cameras.

Because I found nothing suspicious with the wiring associated with the 230-volt power plug, I had to trace "deeper" into the control unit. After a couple of days, I noticed a high-voltage wire (230 volt), mostly hidden from view behind other components, *that connected to a pin on the 29-pin video socket.* And, with a voltmeter, I verified there was 230 volts on the *bottom pin of the middle column of pins* of this socket (Fig. 4), which meant this pin was electrically "hot." And this was true for all the CCTV units that I was testing in my TV lab. In fact, this wire was built into the design.

This "hot pin" was the first sign of possible trouble. This socket is for low-voltage video and sync signals, not electrical power. Why would it be wired for 230 volts, especially when 230 volts was already supplied to the video cameras via the European power sockets?

To try to understand what this 230-volt wire was for, I disassembled a patch cable and examined the pin that this wire would connect with. Fig. 5 is an "X-ray" sketch of the *middle column of pins* of the plug (and socket).[5] In this sketch and other sketches, I've identified the high voltage (230 volts) by the color red, and ground potential (0 volts) by green.

The bottom pin of the plug connected with the "hot" 230-volt pin of the socket (Fig. 5)—but, oddly, there was nothing connected to this pin! Instead, the "hot" wire dead-ended at the plug.

A dead-end wire is frequently called an "orphan wire" because it has no connection with anything else in the circuit. Orphan wires typically appear when design changes are made to circuits, but the electronics designer forgets to remove the obsolete wire from the schematic diagram. And because electronics fabricators build to the schematic diagrams, an orphan wire can live on and on and on!

Also, notice that in Fig. 5—and this turns out to be very important—the top pin of the plug connects to ground (0 volts). Thus, the shield of the coax cable and the coax connector are at ground potential (0 volts). (The center wire of the coax cable plays no role in this investigation.)

As I was examining and making sketches of the socket and plug, I noticed two interesting things about the plug:

• First, the pins of the plug, as well as pins of the matching socket on the control unit, were arranged symmetrically, both left and right, top and bottom (Fig. 6).

• Second, the large male and female guide pins, at the top and bottom of the plug, were *removable and could be interchanged* (Fig. 7). The purpose of the guide pins was to ensure the plug was inserted into the socket correctly.

Eureka! I immediately realized the terrible significance of this configuration: if the guide pins of the plug were switched, then the patch cable could still be inserted into the socket on the control unit if the plug is turned upside down. If that were to occur, then the pin that had been at the top

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[5] In this sketch, I only show one coax cable because, as it turned out, the other two cables played no role in this investigation.

of the plug would now be at the bottom (Fig. 8). This pin would now connect to the "hot" orphan wire and the coax connector of the patch cable would be "hot," 230 volts (Figs. 8, 9).

To put it very simply: If this interchange of the guide pins had occurred, there would have been lethal voltage on the coax connector. Thus, at the time of his death, it was possible that Pierre Noir could have been working with a patch cable that exposed him directly to 230 volts.[6] It became critical for us to get possession of that patch cable and examine it.

Immediate Action

I informed my boss, Ed Kerr, about this serious problem with the patch cable and the danger to anyone handling it (Fig. 10). Our immediate concern was for the safety of our inspectors. There were 20 or so CCTV systems in various stages of implementation and operation at nuclear facilities around the world, and they all had the "hot" orphan wires.

Kerr, and others, got the word out to the inspectors (~125 of them) to stop work on the CCTV systems *immediately*. This was not easy to do in 1978. No cell phones, no text messages, no emails. Just landline telephones, telegrams, cables, and word of mouth.

Les Thorne (England), who was Noir's boss, traveled to Taiwan immediately on hearing of his death. He returned to Vienna a few days later with the actual patch cable that Noir was working with. I examined it and verified that *it was assembled incorrectly* —the guide pins were switched, and there was a direct electrical connection between the bottom pin, middle row, of the plug and the coax connector (Figs. 8, 9,10).

I now had my answer to Barda's question: "Yes, Pierre could have been electrocuted. And, he probably was." The evidence strongly suggests that this tragic accident happened because of two specific problems:

• The "hot" orphan wire
• the incorrectly assembled plug of the patch cable

Both problems had to be present for the accident to occur. If there was no orphan wire, the accident wouldn't have happened, and if the plug had been assembled correctly, the accident wouldn't have happened. But *both* of these problems were present when Noir was working with the CCTV system in Taiwan, and in my investigation, I was able to identify clear evidence of this.

I also had an answer the subtext of Barda's question to me: *could this incident have been deliberately planned?* My answer to this question is *No*. I believe that this incident was a true accident, for three reasons:

[6] Taiwan's electrical power grid is 110 volts. However, as I mentioned earlier, the CCTV system transforms the voltage to 230 volts.

• First, no one in Taiwan had access to the schematic diagrams of the electronics or to the control unit, and it would therefore be virtually impossible for anyone to know about the orphan wire.

• Second, it would also be virtually impossible for someone to understand that switching the guide pins on the 29-pin plug would result in a lethal voltage on the coax connector of the patch cable.

• Third, if someone was clever enough to figure this out and cause the electrocution, why didn't he/she switch the guide pins back into their original "safe" configuration after the accident to hide the crime? It would have taken only a couple of minutes to make the switch back. Why leave the "smoking gun" at the scene?

Follow up

Over the next few weeks and months, I had many long conversations with inspectors about the accident. They were intensely interested in every detail and every fact. Some of them, I think, understood that what had happened in Taiwan was a terrible accident. Others were not so sure. But it was important to keep these conversations going because of the underlying fear that all inspectors have about what could happen to them if they uncovered suspicious activities at a nuclear facility.

While these conversations were taking place, Kerr and I also had to make sure the CCTV systems currently in the field were not a danger. Our concern was not so much with units that were operating properly—their patch cables were probably fine—but with units that were being installed or being serviced. We also worried about the existence of spare patch cables that could be lying around and inadvertently put into use.

Kerr and I decided the safest—and quickest—thing to do was to cut/remove the orphan wires inside the control units. This would eliminate the hazard. I developed instructions for inspectors on how to safely cut the orphan wires, and I also trained several of them how to do it using the CCTV units in my lab. I personally made a quick trip to the Pickering Nuclear Station in Canada to cut the orphan wires in two CCTV units (a total of four video cameras) that were being used in an important verification exercise of fuel transfer in CANDU reactors.

Some inspectors lost all confidence in the CCTV units and had them shipped back to Vienna. It was my understanding that all the CCTV units would eventually be returned to Vienna to be updated by Psychotronic Elektronische Geräte with a new front panel that replaced the 29-pin video sockets with standard female coax sockets, which eliminated the need for patch cables.

During the rest of my time at the IAEA—my family and I returned to Los Alamos in June 1978—I met several times with Leon Green (POTAS) and John May (U.S. Mission to the IAEA) to discuss the accident and find ways the United States could assist the IAEA in developing a safe CCTV system. POTAS quickly initiated a new project with Sandia National Laboratory in Albuquerque, NM to develop an improved low voltage CCTV system. Doug McGovern, an engineer from Sandia, came to Vienna for a few months as a short-term expert to help design and develop this new system. McGovern's office was located next to my TV Lab, and he spent most of his time studying the system and talking with inspectors about what they would like to see in a new unit.

I also testified to an Austrian "Workers Compensation Committee" about the cause of Noir's death. This committee was to decide if Noir's widow qualified for death benefits, which I believed she did. I never learned what they decided.

Switzerland in the Spring

Sometime that spring—I don't remember exactly when it was—I returned to the Beznau nuclear power station in Switzerland to follow up on our outdoor surveillance exercise. The spent fuel transfer operation had finished, and I met with Lumetti at the facility to review the video tape. When we entered the small room in which we'd set up the CCTV control unit, the room was full of people—maybe a dozen or more. They were executives and high-level managers from the power station, representatives of the Swiss atomic energy commission, the Swiss nuclear regulatory commission, etc. They had come to witness the time-lapse video of the spent fuel transfer operation.

I hadn't expected a crowd! When we had installed the system several months earlier we'd had the help of one technician from the plant. After introductions all around, it was showtime. I unlocked the door of the unit and turned on the monitor.

Fortunately, we had video images from both cameras! I quickly checked the video recorder and ascertained that the take-up reel was almost full and the supply reel almost empty. I rewound the video tape and began playing the recordings—and we had good quality time-lapse images. The heated camera enclosures had worked.

For the next quarter hour or so we watched as days and nights came and went. We saw sunshine and snow and rain and fog and ice. And we saw the locomotive transfer spent fuel casks along the train track from the first building to the second, over and over again. After about 15 minutes, our visitors had seen enough. They politely excused themselves—and left.

I was somewhat amused how quickly our visitors lost interest in what Lumetti and I had done. Our 15 minutes of fame was over. But that's the way it is with a successful verification exercise. If done well, the equipment performs as designed and the inspector does his/her job professionally, then no one notices. But there is a quiet satisfaction in this invisibility.

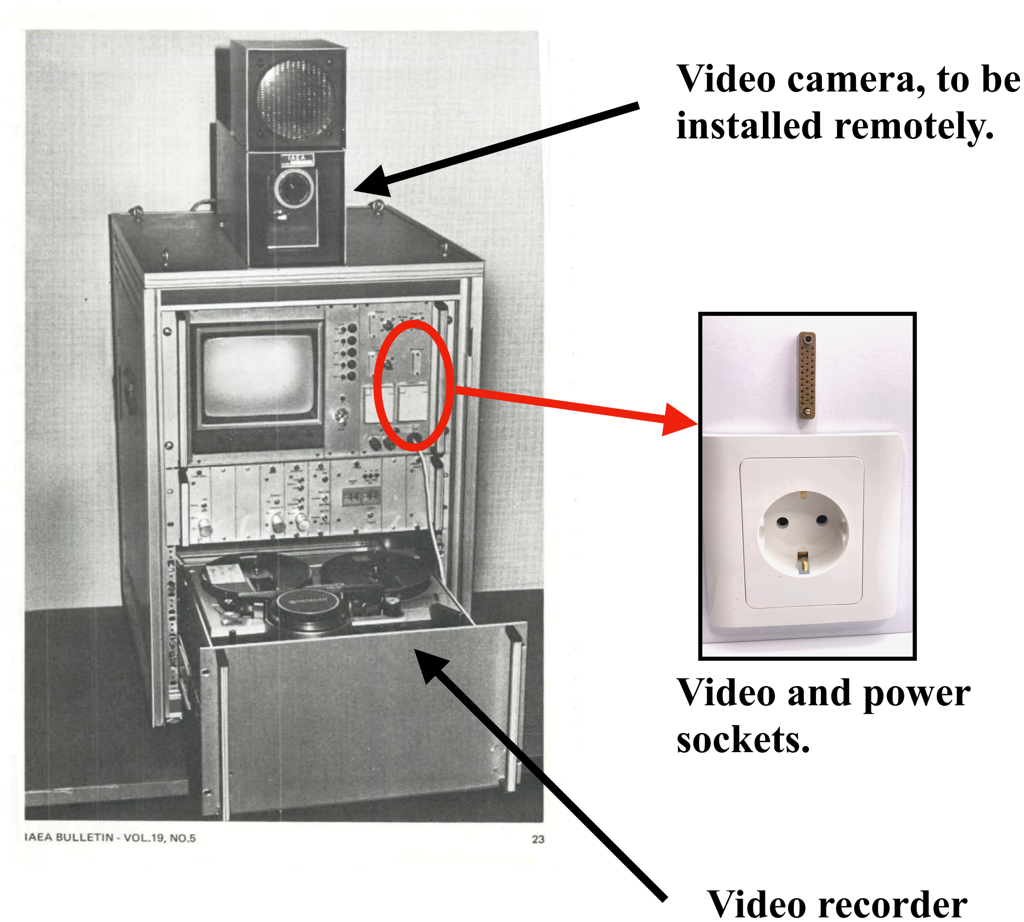

Fig. 1. IAEA CCTV control unit, circa 1977. (Photo from *IAEA Bulletin*, vol. 19, No. 5, October, 1977.)

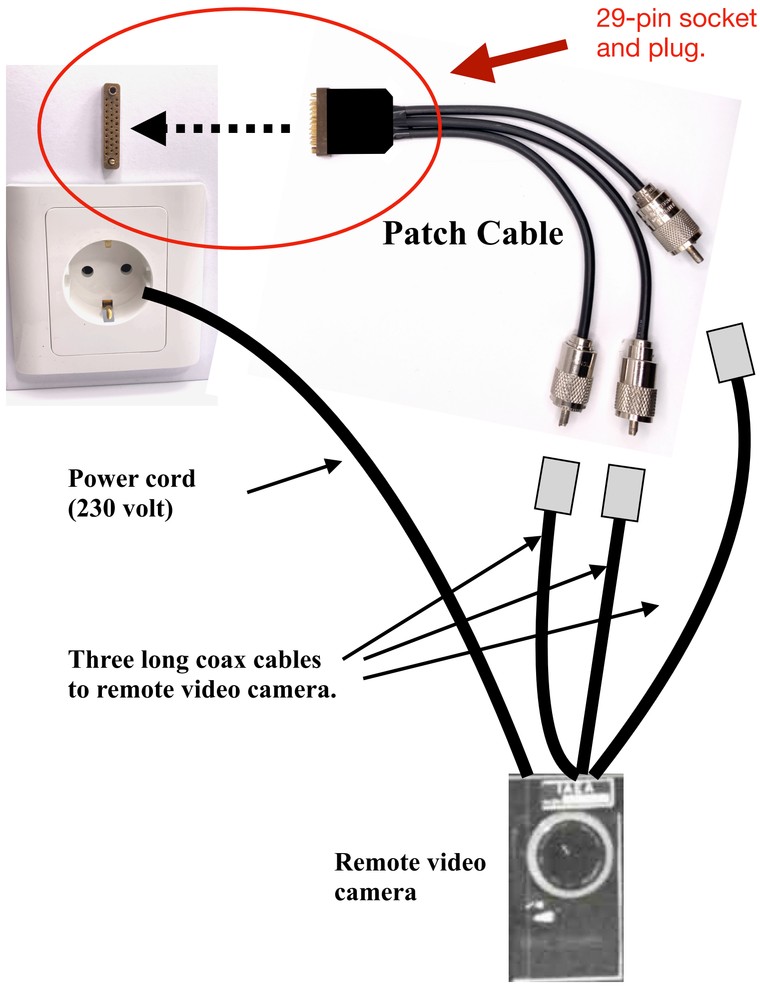

Fig. 2. Power and video connections to remote camera. The 29-pin socket and matching plug on the patch cable (highlighted above) are important in this investigation.

Fig. 3. Replica of patch cable and 29-pin socket on control unit.

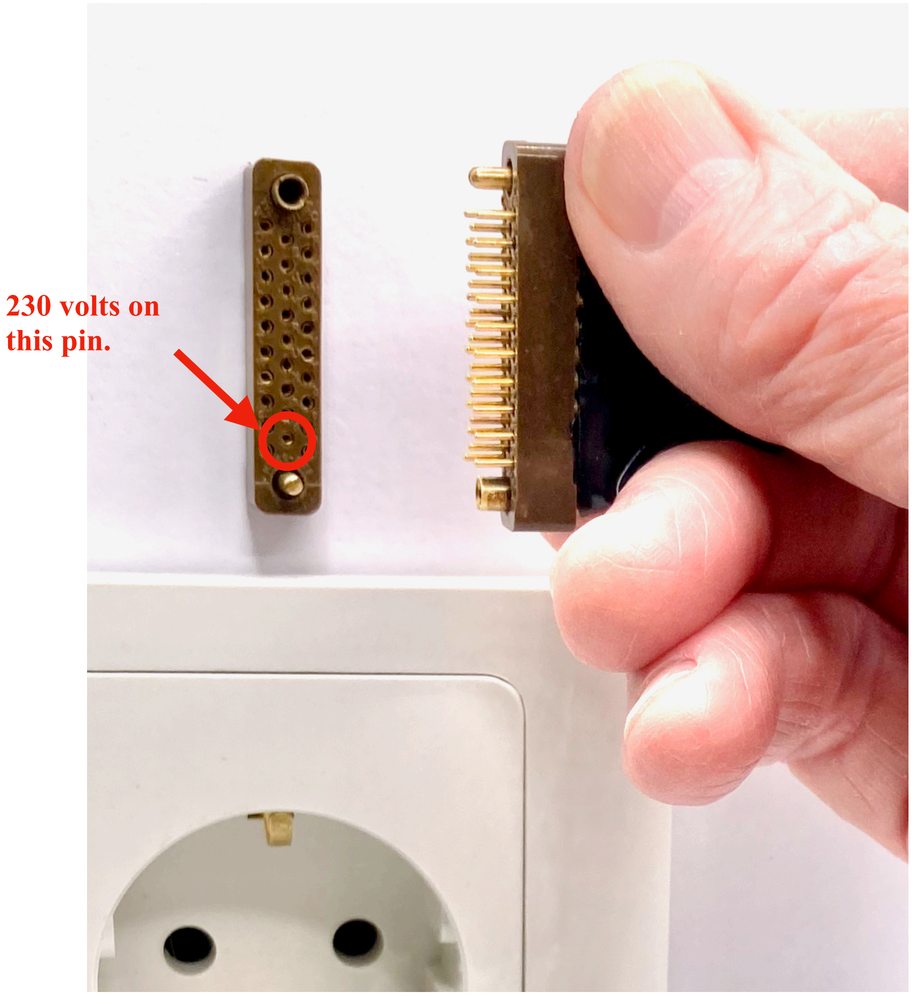

Fig. 4. Close-up view of the 29-pin socket and matching plug on the patch cable (replica). Surprisingly, 230 volts was measured on the bottom pin, middle column of pins.

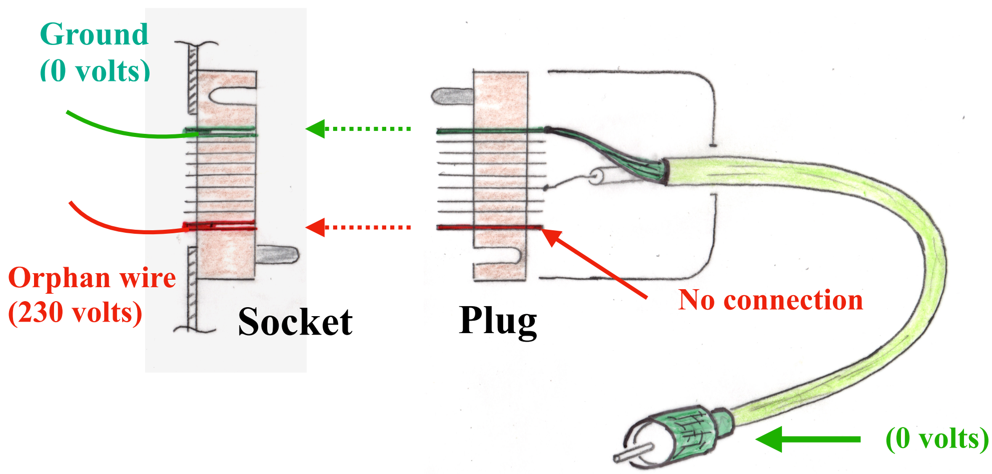

Fig. 5. Sketch of wiring of socket on control unit and plug on patch cable. Middle column of pins.

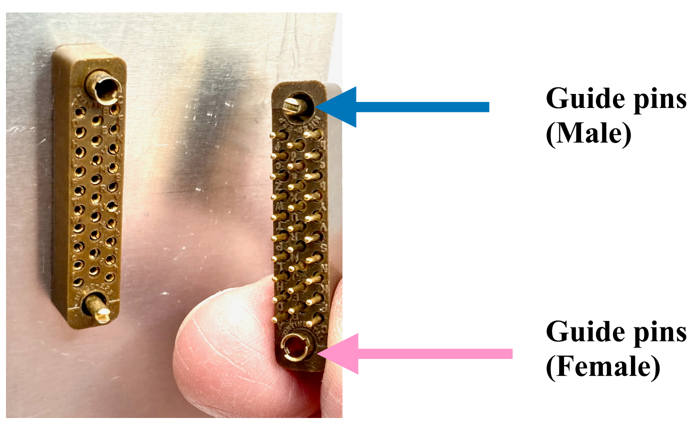

Fig. 6. Guide pins and symmetrical pattern of pins on socket and plug (right/left, top/bottom).

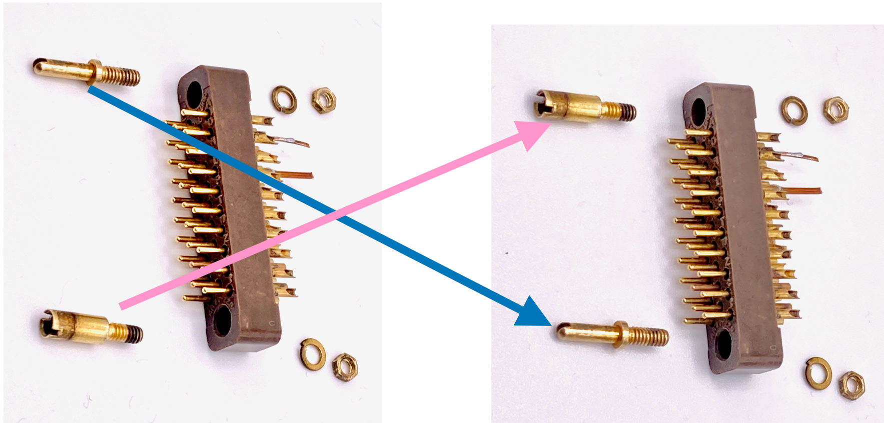

Fig. 7. Incorrectly assembled plug on patch cable. Guide pins switched by mistake. The plug will still fit into the socket on control panel if it is turned upside down.

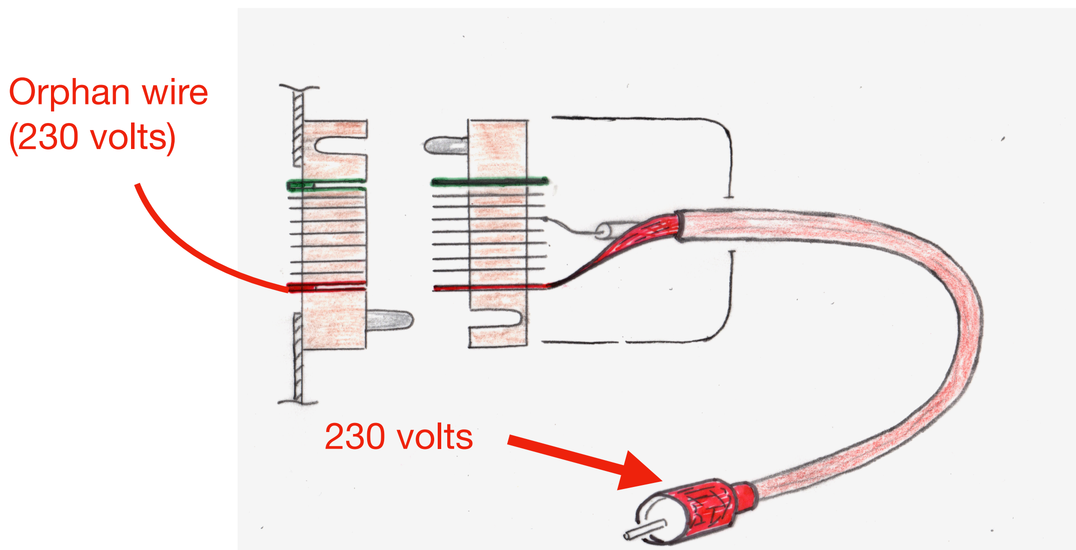

Fig. 8. Incorrectly assembled patch cable. 230 volts now present on coax connector!

Fig. 9. Incorrectly assembled patch cable. Guide pins interchanged. 230 volts on one of the coax connectors.

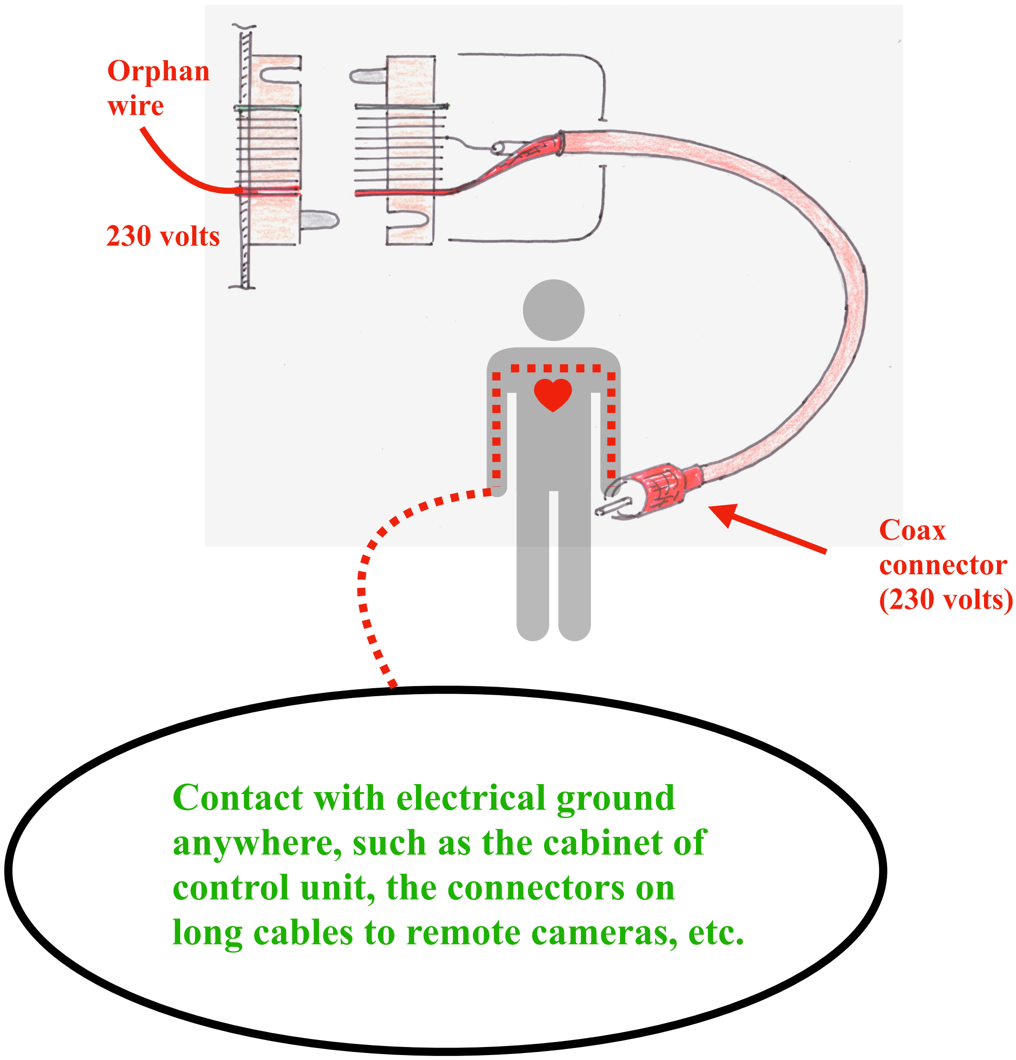

Fig. 10. Electrocution accident. Incorrectly assembled plug on patch cable.

End