CHERNOBYL: ACCIDENT BY DESIGN[1]

Properly understood, Chernobyl was not an accident but a disaster of Soviet design

By Henry Sokolski

As we struggle to make sense of the Chernobyl reactor disaster, we would do well to remember Friedrich Engels' explanation of so many other incidents of class warfare – that this too was no accident. Indeed, by emphasizing the incident's aberrant aspects, our press has overlooked two of its most important causes: shabby Soviet construction and a Soviet compromise between power and military production concepts that produced an inherently unsafe reactor.

These points are hardly academic. Approximately 20 reactors like Chernobyl are still on line in the Soviet Union. Fresh disasters are waiting to occur.

Also, and because of this, both western and eastern Europe now have serious cause to worry about how the Soviets conduct Soviet business. Whether this concern will outlive our immediate wish to see the Soviets limit damage from this accident depends upon our understanding that the accident was not purely aberrational but Soviet in character.

Consider the reactor's construction. Unlike nuclear construction in the West, there was no serious licensing or regulatory check. In fact, the Soviet Union has no separate regulatory agency like the US Nuclear Regulatory Commission or public licensing proceedings like those conducted in the Federal Republic of Germany or Great Britain.

We also know that the plant was built with undue haste. In the West, where both the media and government must respond to possible public dangers, such practices would normally increase the level of concern and oversight. In the Soviet system, which can generally choose how much it wishes to make public and which is focused on meeting five-year plans, the reverse was the case.

Thus, an analysis of the Ukranian press recently published by Bohdan Nahaylo of Radio Liberty notes that the project's "unprecendented tempo" and experimental construction methods were points initially praised in the Soviet Ukrainian media. Construction time for Chernobyl's planned fifth reactor was actually reduced from three to two years (similarly sized Western reactors – even those built by the speedy Taiwanese –are constructed in no less than 4 to 6 years).

Not surprisingly, the plant's technical difficulties abounded. Just a month before the accident, matters became so bad that it was necessary to make it a matter of public discussion. On March 27th a Ukrainian

[1] Originally published in *NBC Defense & Technology International*, vol. 1, no. 3, June 1986

magazine noted that serious "problems with the first power blocks were passed over to the second, from the second to the third, and so on, and as a result they multiplied." The magazine also noted that minimal requirements of safety were being jeopardized by materials sent to the reactor site that were of inferior quality and that the labor force was itself undisciplined and demoralized.

One could accuse the West of having experienced similar construction problems although they rarely have been this egregious or persistent. It also is true that many of these nuclear problems have been experienced in the Eastern bloc. What made such practices at Chernobyl so fatal, however, was their application to the construction and operation of a power reactor that is used primarily to produce electricity nowhere else but the Soviet Union and whose design is inherently unsafe.

This reactor, the large channelized graphite-moderated boiling water reactor (in Russian known by the initials RBMK), differs significantly from light water reactors (LWR), which are the predominant power reactor type operated in Western nations and the Eastern bloc.

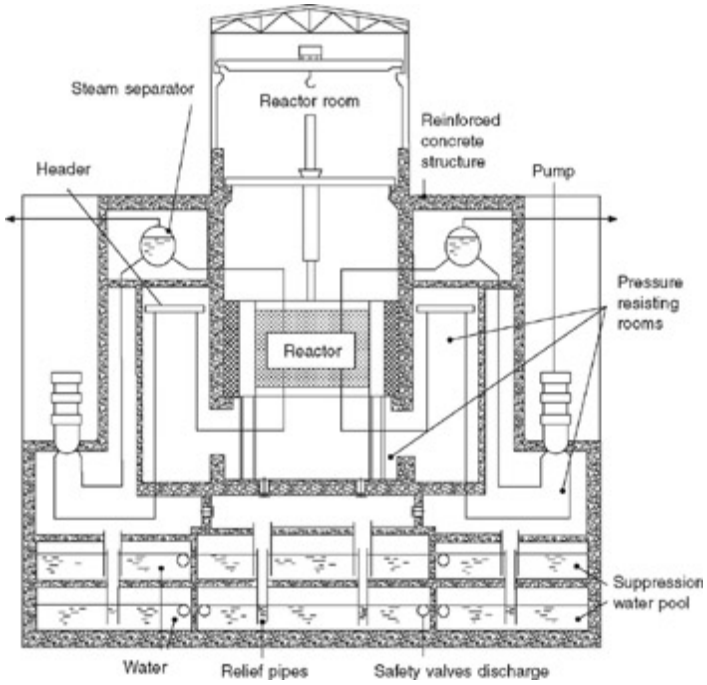
LWR designs were first developed in the U.S. as naval reactors. As a consequence, they had to be compact, efficient, and safe to operate in submarines. The Soviet design, in contrast, was hastily put on line in 1954 in response to America's international promotion of civilian nuclear power under Eisenhower's Atoms for Peace Program. It was directly derived from the only reactor design the Soviets had any experience with – a military plutonium production machine.

Although the Soviets' current 1,000-MWe RBMK reactor design has come a long way since its 1954 5,000-kW precursor, it still shares many of the design features of the Soviets' original military production reactors. Apparently, the Soviets consciously decided to retain these features in the RBMK not only because it would have been inconvenient to try to eliminate them, but because they wanted to retain the option of switching the machine from civilian to military production purposes if necessary.

This convenient duality, however, came at the cost of safety on several counts. As the Western press has emphasized, these reactors have no containment building over them to prevent serious releases of radioactivity into the atmosphere in the case of a reactor accident. With the Three Mile Island accident in 1979, the Soviets began to build containment buildings for their LWRs. They decided against doing this with their RBMK plants, though, because the RBMKs' power cores were so much larger than those of the LWRs that building containment was simply impractical.

Unfortunately, RBMKs are far more likely to produce an accident, and therefore, need a containment building more than an LWR. Unlike LWRs which tend to shut down on their own when there is coolant loss, RBMKs' power levels immediately go up exponentially with such leaks. In such instances the only way to prevent a melt-down is for boron rods to be inserted immediately into the reactor core. This is not always possible.

Compounding this hazard is just how common reactor coolant losses are for RBMKs. Unlike LWRs, which must be shut down to be fueled, the RBMK's fuel is loaded and unloaded while the reactor is operating under high temperatures and pressures. This is a common feature of virtually all military reactors and is critical for the production of weapons-grade plutonium. However, it increases the likelihood of coolant being lost.



Also, unlike LWRs, which have all of their fuel residing in one large, common pressure vessel, RBMKs have each of their fuel elements contained in individual pressure tubes. Again, this makes sense if you want on-line fuelling capabilities but it adds significant risks. As each of the tubes is under pressure, each must have a pressure valve of its own. As a consequence, the RBMK has many more pressure valves that could stick open and cause a loss of coolant than LWRs.

Also, because each of the RBMK's fuel rods is tightly contained with its water coolant in its own pressure tube, it is possible for the fuel to touch the side of the tube, creating a hot spot and possibly a blow-out of the pressure tube itself. The likelihood of such contact is increased due to vibration of the tubes. Unlike LWRs, which have a single large pressure vessel, the RBMK's individual pressure tubes are susceptible to such agitation since they are much lighter than the alternative pressure vessel.

These points are only illustrative of the general theme; there are others. Nor is there much room for dispute about the safety hazards of the RBMK or that it has dual-use military-civilian design. In fact, the Soviets themselves have confirmed both points. Thus, they have never allowed the RBMK reactor to be exported and have chosen instead to export their LWRs, which raise fewer proliferation problems. As for Soviet recognition of the RBMK's inherent safety flaws, the Soviets announced in 1983 that they would only plan to build additional LWRs for civilian applications.

Unfortunately, in the West these points have not been emphasized. Instead, the focus has been on the Soviets' lack of candor about the accident and their unwillingness to allow Western nuclear experts to offer much help. Certainly, Soviet secrecy about the accident is telling in one respect. If the Soviets are unwilling to be open when it is clearly in their interest, how much candor or honesty can the West expect from them when it is not clearly in their interest (e.g. arms control)?

Focusing on this point alone, however, blinds us to considerable portions of the story. It mistakenly suggests that if the Soviets do reveal more about the accident (as they are doing over time) and contain or limit the damage it had done, they will have addressed all that matters.

This is not the case. Chernobyl is a peculiarly Soviet reactor disaster. This should concern us given that some 20 other Soviet reactors like it are still operating. What is peculiarly Soviet about Chernobyl is that the Soviets accepted the inherent safety hazards of the RBMK design because it afforded a military option that seemed attractive.

Given these facts it is difficult to blame the accident on the general riskiness or complexity of nuclear power alone. Properly understood, Chernobyl, in fact, was not an accident but a disaster bound to happen, one quite literally of Soviet design.