Nuclear explosions caused the Chernobyl disaster

Bob Leonard

The severe nuclear reactor accident at Chernobyl in Ukraine in 1986 involved two explosions in rapid succession that destroyed the reactor core and released radioactive isotopes to the atmosphere in large quantities. The radioactive contamination of vast areas has been widely studied and publicised since. But a detailed study of the explosions has been essentially unavailable and unpublicised in the deluge of propaganda and deliberate misinformation right up to the present.

The public has been fed an exclusive diet of media stories describing the reactor explosion as a steam explosion. In the 20 April issue of *New Scientist*,[1] the steam explosion scenario was again put forth as fact, but this time in the context of a novel hypothesis that the core was blasted 14 metres above the reactor building before exploding itself in an undefined manner. The article does describe two explosions.

A nuclear power reactor cannot experience a nuclear explosion according to the industry, the nuclear navies, and other proponents of nuclear power. Would the public have accepted nuclear power if there had been evidence that a civilian reactor could explode massively due to an uncontrolled chain reaction? No. The solution to the problem was to create the myth that such an explosion is impossible - and it worked for over 40 years. The NZ government's Special Committee on Nuclear Propulsion listed as "Myth One: A nuclear reactor can become a bomb".[2] This is the Somers committee that gave the green light to visits by nuclear powered ships to NZ harbours. They gave a quote in support of the myth: "...it is absolutely and unequivocally scientifically impossible for a reactor to blow up like an atomic bomb".[2] That would seem to squelch any argument before it began. But in fact, the use of the term "bomb" muddies the waters of debate. And this confusion is deliberate; it makes it difficult to argue that an explosion could be nuclear without being a true "atomic bomb" in the multi-kiloton range.

But the nuclear argument has been made forcefully and convincingly in a paper by D.G. Arnott and R.D. Green entitled "Chernobyl: unique safety valve for a reactor nuclear explosion".[3] Commander Rob Green will be well known to followers of the World Court Project. He is the UK chair of WCP and a frequent visitor to Aotearoa. Arnott and Green summarised their main findings as follows:

1. Chernobyl was primarily a nuclear explosion.
2. No containment could have withstood such a powerful explosion.
3. The loose-fitting 2000 tonne RBMK pile-cap acted in effect as a "safety valve" by prematurely terminating the chain reaction. This reduced the energy of the explosion and hence fission product release. It also confined damage to Unit 4, sparing three adjacent reactors and two highly radioactive spent fuel stores.
4. A pressurised, internal containment - as in all British thermal reactors - would have increased the violence of the explosion.
5. At least one scenario exists for a nuclear explosion in British Advanced Gas-cooled Reactor (AGR), Pressurised Water Reactor (PWR) and the Dounreay Fast Breeder Reactor (FBR).

The scientific basis for their analysis and conclusions is an obscure paper published in June 1990 by five nuclear physicists at a university in Madrid, Spain.[4] The journal is the long-established American *Nuclear Technology*. The Spanish article was called to the attention of Arnott and Green by Russian scientist Zhores Medvedev. It is a highly technical article, difficult to grasp without considerable background in physics. The best summary of the explosion mechanisms to be found in various papers provided to ABC by Rob Green was written by Prof R.V. Hesketh, emeritus professor of physics.

The quote below is from a briefing paper prepared by Prof Hesketh:

> **"How the explosions occurred and what they were**
> The Emergency Protection System [EPS], far from protecting the reactor, triggered its destruction: the neutron power rose, initially with doubling time of about one second and then some ten times faster, the reactor went prompt critical, and four seconds after the pressing of the EPS button **the first nuclear explosion** occurred, releasing some 200 gigajoules [GJ] of nuclear energy, of which up to ~50 GJ, and perhaps as little as 0.4 GJ, was used in expelling the cooling water from the reactor. The larger part of the energy from this first explosion

remained in the reactor core, as heat in the fuel. This remaining energy broke up the reactor core.... Fuel 'disaggregation' quenched the first explosion, but the concomitant collapse caused a **second, larger, nuclear explosion** some two seconds after the first. This second 'prompt supercritical burst' released approximately 1000 GJ of nuclear energy into the fragmented, 'hot and dry' reactor." (emphasis added)

Just how big an explosion is 1000 GJ of energy release? According to Arnott and Green it is the equivalent of just under a quarter of a kiloton, or roughly the same yield as the W54 warhead deployed in a variety of US battlefield nuclear weapons in the 1960s.

Whether or not a reactor can explode "like a nuclear bomb" is a red herring in this debate. A reactor is not designed like a nuclear bomb, i.e., to explode efficiently. But, a runaway supercritical nuclear reaction will cause a massive explosion compared to a chemical or steam explosion, i.e., an inefficient nuclear explosion.

Arnott and Green argue that no containment could ever survive a nuclear explosion, however inefficient the "bomb" might be. They go on to ask, "Could a nuclear explosion happen in a British reactor?", or indeed any western-type reactor. Their conclusion is that "... a nuclear explosion could happen in an AGR, PWR and the Dounreay FBR; and that, if it did, it would be far worse than Chernobyl". Many western reactors now in operation are of those types. The public has long been reassured that western reactors have containments that would confine any conceivable chemical or steam explosion and prevent serious spread of radiation into the environment. The consequences for the nuclear industry of acknowledging that nuclear explosions are possible in reactors could be the demise of nuclear power in the west.

Sir John Hill, a former chairman of the British Atomic Energy Authority (AEA), acknowledged in a 1992 article that a nuclear explosion did occur at Chernobyl.[5]

Arnott and Green conclude: "It is clear from this [Hill's admission] that British scientists have also known about the possibility of reactor nuclear explosions from the beginning. Yet even Chernobyl was not enough to jolt the AEA into preferring scientific integrity to the vested interests of the nuclear power industry."

Don Arnott is a retired British medical physicist specialising in medical uses of radioisotopes.

Rob Green is a retired Commander with 20 years service in the Royal Navy. His last appointment was officer in charge of intelligence support for the Polaris nuclear submarine fleet.

References

1. Mullins, J. 1996. The case of the missing core. *New Scientist*, No. 2026:40-43.
2. Somers, Sir Edward, *et al*. 1992. The safety of nuclear powered ships. Report of the Special Committee on Nuclear Propulsion. Department of the Prime Minister, Government of New Zealand.
3. Arnott, D.G. and R.D. Green. 1992. Chernobyl: unique safety valve for a reactor nuclear explosion. Proc. of a national conference: "The legacy of Chernobyl - Lessons for the UK".
4. Martinez-Val, J.M. *et al*. 1990. An analysis of the physical causes of the Chernobyl accident. *Nuclear Technology*, 90:371-388.
5. Hill, Sir John. 1992. Book review on the 1957 Windscale accident. *ATOM* (house journal of the AEA), No. 421:7. (as cited in Arnott and Green)

About *Peace Researcher*

Peace Researcher is published quarterly by the Anti-Bases campaign, Christchurch. The editors are Warren Thomson and Bob Leonard. Our journal covers a range of peace issues with emphasis on foreign military bases and intelligence topics. Contributed articles will be considered for publication based on subject matter and space requirements. We are particularly interested in reports of original research on peace topics in Aotearoa and the wider region of Australasia and the Pacific. Our address is:

Peace Researcher
P.O. Box 2258
Christchurch
Aotearoa/ New Zealand

CHERNOBYL EXPLOSION CONFIRMED IN U.S.

- Bob Leonard

Peace Researcher initiated a letter to the Union of Concerned Scientists (UCS) in the United States to ask their opinion of the nature of the explosions that destroyed one of the Chernobyl nuclear reactors in 1986. *PR*-9 contained an article describing substantial evidence that the explosions were nuclear and not chemical or steam explosions. We can confirm that both the UCS and the US government consider that the Chernobyl accident involved at least one nuclear explosion.

The UCS is the leading independent watchdog concerned with safety in the American nuclear industry. They have a long history of campaigning for nuclear safety and we considered that their evaluation of the articles we reviewed in *PR*-9 would be of considerable interest. Portions of the UCS response, written by nuclear safety engineer David A. Lochbaum, are quoted here:

> "The data presented in the Martinez-Val paper[1] is consistent with the findings reported in NUREG-1250, 'Report on the Accident at the Chernobyl Nuclear Power Station,' the official United States government inquiry into the accident and its domestic implications. For example, Figure 4.3 from NUREG-1250 indicates that integrated energy deposited into the fuel to be approximately 1,400 cal/gm [calories per gram]. For the core loading, this represents approximately 1,112 gigajoules or 0.265 kilotons. These results compare very closely with the values reported by Martinez-Val."
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> "In your letter, you solicited our opinion on the nature of the Chernobyl explosions. I agree with the conclusions presented in the Martines-Val paper. I also hasten to point out that the official US inquiry also pointed to the second explosion being a 'nuclear explosion', although the industry term for such an event is a 'prompt critical excursion'.[2] ***Thus, it is officially recognized that Chernobyl was essentially a nuclear explosion.***" [Emphasis added, ed.]
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> "Your letter indicated that if the nature of the Chernobyl accident were clearly understood, the implications for the nuclear industry would be substantial. Unfortunately, we have not found that to be the case. The lessons of Chernobyl were largely discounted due to differences between the Russian RMBK design and western reactors (e.g., the RMBKs have positive reactivity coefficients and lack containments.") There is no indication in the letter that the UCS attempted to correct the "discounting" by the nuclear industry that a nuclear explosion in a reactor would destroy any reactor regardless of its design or the existence of a containment. This point was strongly made by Arnott and Green as described in our article in *PR*-9: "... no containment could ever survive a nuclear explosion, however inefficient the 'bomb' might be". The Russian reactor designers seem to have accepted the possibility of an uncontrollable nuclear reaction: "The loose-fitting 2000 tonne RBMK pile-cap acted in effect as a 'safety valve' by prematurely terminating the chain reaction. This reduced the energy of the explosion and hence fission product release. It also confined damage to Unit 4, sparing three adjacent reactors and two highly radioactive spent fuel stores".[3]

Arnott and Green went on to state emphatically that western reactors were also susceptible to nuclear explosions. And on this point David Lochbaum of UCS seems to concur: "There were several invaluable lessons to be learned from Chernobyl. The plant was found to be in non-conformance with several safety regulations.... These precursors are found in numerous minor incidents at nuclear power plants in this country [USA], yet our regulators fail to recognize the importance of these warning signals."

Peace Researcher is disappointed that UCS would state "regulators fail to recognize the importance of these warning signals". It is naive to think US regulators don't know precisely what they are doing when they whitewash the "containment" issue. Arnott and Green's conclusion applies equally to the US regulators: "...Chernobyl was not enough to jolt the Atomic Energy Authority into preferring scientific integrity to the vested interests of the nuclear power industry".

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1. Martinez-Val, J.M. *et al*. 1990. An analysis of the physical causes of the Chernobyl accident. *Nuclear Technology*, 90:371-378.
2. The nuclear explosions that destroyed Hiroshima and Nagasaki were also "prompt critical excursions". This is nuclear industry nukespeak at its finest.
3. Arnott, D.G. and R.D.Green. 1992 Chernobyl: unique safety valve for a reactor nuclear explosion. Proc. of a national conference: "the legacy of Chernobyl - Lesson for the U.K.".

REACTOR NUCLEAR EXPLOSION

tekknorg.wordpress.com/2011/11/12/the-atomic-reactor-explosions-of-fukushima-and-chernobyl/

The Soviet Environment: Problems, Policies and Politics von John Massey Stewart

per cent had melted. The collapse of the structure blows this burning mass from the fuel channels into the water, thus contributing to an instant steep increase of pressure and causing the entire reactor to explode. The model demonstrated that such an explosion rather than an instant expansion of steam took place in the course of less than a second (some tenths of a millisecond).

Most important in these conclusions was the fact that the heating up of the reactor took place at the expense of the accumulating flow of fast neutrons. In this case the heating-up process takes place so quickly that it is simply impossible to cool it down by the use of water. The water has not got sufficient thermal conductivity to absorb heat during such reactions. Reactions on fast neutrons take place at least 1,000 times faster than ordinary chemical and physical processes. The nuclear explosion, in the assessment referred to by the technical term 'prompt criticality excursion', was the first; the reactor explosion was an effect of it. The authors of the British assessment admit that 'if the reactor becomes critical on fast neutrons then a change in power takes place in periods of time so short that they exceed the speed of any control system. Consequently, the reactor becomes uncontrollable'.

Apart from these official assessments made by the American and British organisations in charge of nuclear energy programmes, a number of specialist seminars and discussions were held in both countries, in an attempt to provide an independent critical analysis of both Soviet and Western official estimates. Interesting seminars were organised by British and American Nuclear Energy Societies (the Nuclear Society of the USSR was established only in 1989). Materials from the British Nuclear Energy Society's seminar on Chernobyl were published in 1987.[6] The assessment made by the British society assumes that during the reactor's second rapid increase of reactivity, local temperatures at the places where the fuel melted could have reached 4,000 to 5,000°C. These temperatures are undoubtedly no longer 'chemical'. In this case even a steam explosion is impossible, as the steam ionises and dissociates into gases – oxygen and hydrogen. These are detonating gases, but they do not explode at such temperatures. The English radiobiologist Don Arnott has called the explosion 'a nuclear explosion of the reactor type', stressing its difference from the explosion of a nuclear bomb, during which the temperature in the epicentre reaches a million degrees. In Arnott's view, if the reactor's structures had been bolted together, or covered by a special containment, the explosion would have been much more powerful – destroying everything surrounding it.[7]

REACTOR NUCLEAR EXPLOSION

Chernobyl: a technical appraisal : proceedings of the seminar organized by ... von British Nuclear Energy Society

http://books.google.de/books?id=oEqd0IeAhccC&pg=PA6&hl=de&source=gbs_selected_pages&cad=3#v=onepage&q=4000%20to%205000%C2%B0K&f=false

reactivity left in the rods which were in core and the others at the top of the core could not be inserted fast enough to overcome the power increase caused by the competing factors cited above. The positive void coefficient of reactivity inherent in the RBMK design, coupled with the positive power coefficient, continued to add more reactivity and the prompt critical value was exceeded. Within four seconds after 1:23:40 the power was calculated to be one-hundred times full power. This catastrophic increase in reactor power resulted in fuel fragmentation, rapid steam generation and ultimate destruction of the reactor core and associated structures.

EXTENT OF THE DAMAGE

23. The extent of the damage is based on model predictions, visual observations and post-accident on-site measurements.

(i) It is assessed that approximately 30% of the fuel fragmented with fuel temperatures reaching 4000 to 5000°K. Fuel was ejected from the core. The major part of the fuel seems to be below the reactor space, with a portion above the core and in adjacent rooms.

This is no longer "chemical"

nor does oxygen / hydrogen explode

at these temperatures!

IT IS NUCLEAR!

NUCLEAR EXPLOSION OF THE REACTOR TYPE