DECLARATION BY PROFESSOR NORMAN DAVID DOMBEY

1) My name is Norman David Dombey of DPA. I was appointed Professor Emeritus of Theoretical Physics at the University of Sussex on retirement in October 2003. I was Professor of Theoretical Physics from 1989 to 2003 and Reader in Theoretical Physics from 1969 to 1989, both at the University of Sussex. I was also an Associate Fellow of the Science Policy Research Unit at the University of Sussex at various times from 1974 until my retirement where I participated in their energy programme and their arms control programme.

2) During my career as a theoretical physicist I have published over 100 papers on physics and related subjects in academic and professional books and journals, popular scientific magazines and newspapers. My most recent scientific research paper was published in the leading physics journal Physical Letters A in August 2006 while my most recent article for the general public was my article on the Litvinenko case published in the London Review of Books in August 2007 and included as Document A. I have published scientific research papers on elementary particle and nuclear theory and on relativistic quantum theory. I have also written articles on nuclear weapons and nuclear proliferation, on arms control and on nuclear power in journals including Nature, New Scientist and the Bulletin of Atomic Scientists and in newspapers including The Financial Times, The Times, The Guardian, The Independent on Sunday and The London Review of Books.

3) I have held research or visiting posts at scientific institutions in many countries including California Institute of Technology, University of California at Berkeley; Harvard University, Brookhaven National Laboratory and Stanford University in the United States; the European Centre for Particle Physics CERN in Geneva and the International Centre for Theoretical Physics in Trieste; L'Istituto Nazionale di Fisica Nucleare in Frascati, and the Imperial College of Science and Technology in London.

4) I have been a Specialist Advisor to the House of Commons Select Committee on Energy for their inquiry into Britain's nuclear power programme during 1979-81; a member of the Minister of State's Advisory Panel on Nuclear Non-Proliferation; a consultant at Los Alamos National Laboratory in the United States, and also at Daresbury National Laboratory and the Rutherford Appleton Laboratory in the UK; a member of the Royal Institution of International Affairs and I am member of the International Institute of Strategic Studies.

5) I spent the academic year 1962-63 at Moscow State University when I took part in one of the first exchanges in higher education between the Soviet Union and the UK, sponsored by the British Council on the British side. In addition to learning Russian, I was invited to several Soviet scientific institutions during that visit.

6) I visited the Landau Institute of Theoretical Physics of the Academy of Sciences in Moscow in 1988 with colleagues from the University of Sussex on a visit sponsored by the Royal Society. This was during the time of glasnost' when Mr. Gorbachev was Communist Party Secretary. I was authorised to invite Academician Andrei Sakharov to the University of Sussex to receive an honorary degree while I was Moscow. This I did.

7) Academician Sakharov was able to accept this invitation and a similar invitation from Oxford University and visited the UK to receive these degrees in summer 1989. I was his co- host in the UK together with Sir Adam Roberts of Oxford University.

8) I visited the Petersburg Nuclear Physics Institute of the Academy of Sciences in 1992, again sponsored by the Royal Society. This was after the collapse of the Soviet Union when life was very difficult for ordinary Russians and scientists in particular. State institutions were unable to pay their employees and the streets were full of people trying to sell their possessions.

9) Having seen the difficulties face by Russian scientific institutions on my visit in 1992, I applied for a grant from INTAS [the International Association for the promotion of co-operation with scientists from the New Independent States of the former Soviet Union], which was established in 1993 by the European Community in order to support scientists over this difficult period. I became coordinator of a joint research programme involving several universities and scientific institutions in the EU, Russia, Georgia, Armenia, and the Ukraine. The programme involved leading physics institutions in Moscow, St Petersburg, Kiev, Erevan and Tbilisi. This grant allowed me to make further visits to the former Soviet Union during 1993 and 1994.

10) Physics in the Soviet Union was of a very high standard and physicists such as Landau, Sakharov, Zel'dovich, Bogolyubob, Pomeranchuk and many others were the equals of their counterparts in the United States and western Europe. Sakharov and Zel'dovich were leading figures in the Soviet nuclear weapon programme and had played the leading roles in designing the Soviet H-bomb. The Soviet nuclear weapon laboratories were in closed cities such as Arzamas-16 and Chelyabinsk-65, not marked on maps and which foreigners were unable to visit. The nuclear weapon programme was a major priority of the Soviet Union and my Russian colleagues told me that no expense was spared so that the best equipment could be provided. I was also told that Soviet physics generally was a beneficiary.

11) I visited the Petesburg Nuclear Physics Institute in 1992 and 1994. A high flux neutron reactor is operated there using high enriched uranium, a nuclear weapon material, as fuel. Although life generally was chaotic in this period, a high level of professionalism continued within the laboratory. The Russian state and the Russian Academy of Sciences continued to function.

12) I also visited Tbilisi in Georgia in 1994 where unlike in Moscow and St Petersburg professional scientific life had collapsed.

13) In March 2004 I gave evidence to "The Review of Intelligence on Weapons of Mass Destruction" chaired by Lord Butler, since I had written an article entitled "Saddam's Nuclear Incapability" in September 2002 before the invasion of Iraq. My prediction that there was no nuclear threat from Iraq was correct. My article and Lord Butler's letter to me thanking me for my evidence are attached as documents [B] and [C].

11) I have some familiarity with the physics and properties of polonium from my knowledge of nuclear physics, and of its uses because of my knowledge of nuclear weapon programmes in the UK, US and former Soviet Union. Polonium was used in early nuclear

weapons in all three countries as a neutron trigger in conjunction with beryllium.

12) Polonium was discovered in 1898 by Marie Curie and Pierre Curie in the uranium - containing mineral pitchblende. After repeated heating of the pitchblende followed by dissolving the residue in acid they isolated a substance 400 times more radioactive than uranium. Marie Curie named the element in this substance responsible for this radiation polonium, after Poland where she was born.

13) Polonium is a very rare element. There are only 100 micrograms of polonium per ton of uranium ore. It is thus impracticable to make polonium in this way.

14) Since the 1930s, however, it has been known that it can be prepared by irradiating bismuth by neutrons in a nuclear reactor. More precisely Bi-209 absorbs a neutron to become Bi-210 which then beta-decays to Po-210. [Po-210 indicates the isotope of polonium with 84 protons and 126 neutrons. All isotopes of polonium contain 84 protons. Similarly Bi-209 contains 83 protons and 126 neutrons while Bi-210 contains 83 protons and 127 neutrons].

15) Po-210 is intensely radioactive. One gram of Po-210 will emit 140 Watts. Po-210 emits alpha particles [helium ions] with a characteristic energy of 5.407 MeV (million electron volts). It also emits a weak gamma signal of characteristic energy. It has a half-life [the time in which half the material will decay] of 138 days. Because it is such an intense emitter of alpha particles of specific energy, minute quantities of Po-210 can be detected with the appropriate equipment. Quantities of the order of a few picograms (10^{-12} gm) can be detected. Hence the trail of those who brought the Pu-210 to London was easily established.

16) According to the Los Alamos National Laboratory website "Po-210 is very dangerous to handle in even milligram or microgram amounts, and special equipment and strict control is necessary. Damage arises from the complete absorption of the energy of the alpha particle into tissue .... Weight for weight it is about 2.5×10^{11} times as toxic as hydrocyanic acid".

17) The alpha particles emitted by Po-210 is able to knock neutrons out of the beryllium isotope Be-9. Po-210 and Be-9 were therefore used together as neutron triggers or initiators in the first generation of nuclear weapons the nuclear weapon states. Thus facilities for making Po- 210 were established at special state-run laboratories in the US, USSR, UK and France. This is almost certainly the case for China as well but I do not know the details.

18) In the UK, for example, Po-210 was being made at the Windscale reactor in October 1957 when the reactor caught fire. This was kept secret for more than twenty years.Po-210 is no longer used to provide neutron triggers in modern nuclear weapons. A tritium 'gun' is more accurate. As far as I am aware, Po-210 is no longer produced in the west.

19) Po-210 production has, however, continued at the former principal Soviet nuclear weapon city Arzamas-16 which is now called Sarov. A group at Princeton University has been working with the Russian Mininstry of Atomic Energy (Minatom) on plans to convert Russian nuclear weapon facilities into civilian facilities. A report on progress is attached [D]. Page 44 of that report shows that Po-210 production is considered a major commercial activity of the Avangard laboratory in Sarov.

20) According to a well-informed article in the Washington Post by Peter Finn on January 7, 2007, Po-210 production at Avangard constitutes 97% of the world's production of the isotope. Although I cannot confirm the precise percentage, 97% is a reasonable figure as I know of no other large-scale production facility of Po-210.

21) It is therefore highly probable, but not certain, that the Po-210 used to poison Litvinenko came from Avangard. I discuss below whether it is possible to confirm that Avangard was the source.

22) It is, however, unlikely that the reactor used to produce the Po-210 was in Sarov. As far as I am aware, there are no reactors there with a sufficiently high neutron flux. It is most likely that the reactor used to irradiate the Bi-209 which was then processed into Po-210 at Avangard was one at the Mayak facility at Ozersk [former name Chelyabinsk 65] where there are two isotope production reactors called Lyudmila and Ruslan. Pages 47-48 of Document D show that production of medical and industrial radioisotopes is one of the major commercial activities of Mayak.

23) Russia sells Po-210 on a commercial basis to other countries. Po-210 is used in extremely small quantities in antistatic devices; for example in an antistatic gun which is in general use in many garages to improve the the spray finish in spray painting. It can be used to prepare special materials which need anti-static properties. It has a further use as a thermo-electric power source in satellites.

24) It is possible to purchase Po-210 without any licence from suppliers such as United Nuclear Scientific, Sandia Park, New Mexico 87047, USA, who sell a disc in secure packaging containing Po-210 emitting 0.1μCi (micro-curie) for $79. The mass of Po-210 in such a device is about 20 picograms.

25) According to an authoritative scientific article [E] written after Litvinenko's death ingestion of 1 to 3 GBq of Po-210 by an adult male will lead to death within one month in 50% of cases. Since 1 Ci equals 37 GBq, it follows that at least 270,000 discs are required to have sufficient Po-210 to have 50% chance of poisoning an adult male within one month. It would not be possible to order such a large amount without being detected. It is therefore clear that whoever poisoned Litvinenko did not rely on commercial suppliers. I can conclude therefore that if Avangard was the source, the Po-210 which poisoned Litvinenko did not come to the UK through normal commercial channels.

26) "Everything connected with polonium production and application is controlled by governments...You cannot just put any target inside a reactor. It is regulated and checked by many, many people. It would be discovered "said Boris Zhuikov, head of the radioisotope laboratory in the Nuclear Studies Institute of the Russian Academy of Sciences, in an interview with Peter Finn of the Washington Post in the article referred to above.

27) The same article quotes Konstantin Pulikovsky, head of the Russian Federal Service for the Oversight of the Environment, Technology and Nuclear Management: he says that "I can say with complete certainty that no deviations from the rules of storage and transportation of nuclear materials, including polonium, have been discovered at any structures of our fuel and nuclear complex."

28) In my opinion both quotations above are correct. The reactor and production facilities belong to the Russian state and are supervised by the state while extraction of the polonium from the irradiated bismuth can only be done in specialised facilities which can deal with highly radioactive materials: these also are only to be found in laboratories owned and operated by the Russian state. Hence Zhuikov's statement is in accordance with my own thinking.

29) Pulikovsky's statement implies that the practices adhered to at the Avangard and Mayak facilities conform with the high professional standards which are required to work with such intensely radioactive material. That is what I would expect in a major scientific institution in Russia and what I observed myself at other major Russian scientific institutions. This professionalism survived the difficult period following the break-up of the Soviet Union, at least where major scientific institutions were concerned.

30) I therefore conclude that if the material was produced at Mayak and Avangard as is likely, then the Russian state or agents of the Russian state would have been responsible for Litvinenko's poisoning.

31) I now come to the question of whether it is possible to establish that the Po-210 was made at Mayak and Avangard. In my opinion the British authorities will most probably know whether or not this is so. Nuclear forensics--the analysis of samples of nuclear material--to determine their origin and properties is now a well-established branch of applied nuclear physics. Po-210 from the Litvinenko's blood and urine could have been compared with commercial Po-210 known to have originated at Avangard. The impurity content of any residual Bi- 209 in the two samples would have been compared to establish whether the Bi-209 came from a common source ofbismuth ore. A detailed analysis of the isotopic content of the Po-210 in the two samples would show whether the Bi-209 had been irradiated in the same reactor since it would depend on the neutron energy spectrum of the reactor. If the quantity of Po-210 were too small for Aldermaston to analyse, it could have been sent to the Lawrence Livermore National Laboratory for analysis which specialises in this work Document F describes this work. Even now, one year after Litvinenko's death, 20% of the original Po-210 sample will be available which may well be sufficient for the analysis to be carried out.

31) My instructions were to offer an opinion on the source of the polonium used in the poisoning of Alexander Litvinenko and the evidence this provides of complicity of the Russian Federation in the poisoning. My opinion is written in accordance with my obligations listed in Appendix A.

32) My conclusions are:

a) it is probable that the Po-210 used to poison Litvinenko was prepared at the Avangard facility in Sarov, Russia which used one of the isotope-producing reactors at the Mayak facility in Ozersk, Russia;

b) if this is so, the the Russian state or its agents were responsible for the poisoning;

c) **that the British authorities will probably have determined whether the source of the Po-210 was a Russian reactor , and**

d) **even if they have not done so, it may still be possible to determine whether or not this was the case.**

DPA

Professor Norman Dombey
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