

UKAEA HARWELL.

ISSUES AND

PUBLIC SAFETY.

A report specially produce the UKAEA Harwell

Public Local Liaison Committee.

Banbury Environmental Research Group.

May 1990.

UKAEA Harwell - Issues and Public Safety.

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1). Introduction.

1 Harwell is the largest of all the United Kingdom Atomic Energy Authority's research establishments. It is a major centre for research and development work, in many non-nuclear as well as nuclear fields. The site houses many specialised laboratories, which contain some of the most advanced research equipment in the UK. In short, UKAEA Harwell is one of our best research centres in the country and has performed a great deal of work in many specialised areas which has undoubtedly benefited the UK. However, this success masks a great many problems within the establishment itself.

2 As government funding of the UKAEA has diminished, many departments have been finding it harder to do the extensive research work necessary to carry previous discoveries forward, and since the setting up of the Harwell laboratories as a 'trading fund' an increasing amount of work is being done for national and international corporations in specific areas. The decline in the number of government funded research projects has had a detrimental effect on the scope of the work conducted at Harwell, and already a large number of redundancies have been announced.

3 This year will see two major blows to AEA Technology - the division of the Atomic Energy Authority which run Harwell. Firstly there is the closure of the materials testing reactors, DIDO and PLUTO. This will have a major impact on the scope of research capable on the site, especially on the nuclear side. Secondly there is the loss of their exemption to the Atomic Energy Acts. This again will affect how the operations on the site are carried out. The involvement of the Nuclear Installations Inspectorate in the running of the plant will increase, and this could mean, as in the case of the DIDO and PLUTO reactors, the closure of some parts of the plant.

4 Banbury Environmental Research was formed in September 1989 to perform research into a broad base of environmental issues. The group consists of a number of

individuals performing research in their own areas of interest, but who appreciate the benefit of collaboration and information exchange as a way of tackling specific research problems. These individuals come from a wide area but as the group is administered from an postal address in Banbury, the group took the name Banbury Environmental Research.

5 I personally was involved in researching nuclear issues for the Oxfordshire Peace Campaign (specifically in a small group entitled OPC Research), and coordinated much of the research into safety at Harwell since the end of 1988. You may remember the information which we gave to Liaison Committee members last year. Unfortunately as OPC Research was associated with the peace movement, our research was rather restricted. Therefore when the opportunity arose of joining what is now Banbury Environmental Research, we split away. Banbury Environmental Research is now a totally independent group, not reliant on and particular political party or pressure group for resources.

6 Whilst recognising the obvious benefits of the work at Harwell, both nuclear and non-nuclear, we believe that the current situation in terms of plant safety, and the safety of the material testing reactors in particular, cannot be justified. It is obvious from the research we have done that their privileged position has led to lapses in plant safety. It is this which led us to produce, in 1989, a comprehensive report for the House of Commons Select Committee on Energy, detailing that problems at Harwell, and in early 1990 a second report dealing in more detail with the issues of emergency planning, decommissioning, and the then recent statements made by the UKAEA on the safety of the reactors. This report, like those for the Energy Select Committee, has therefore been produce to help inform members of the Local Liaison Committee, and enable them to make an informed assessment of the information presented by the UKAEA.

7 We expect that the Harwell management will, as they did last year, attempt to discredit our report, and Banbury Environmental Research. I wish to assure you however that we are not militant anti-nuclear fanatics with a grudge against Harwell. In all our work, be it air pollution, water or nuclear research, our primary concern is public safety. The primary purpose of the group is to research issues and provide information to the public on request. You may be prepared to accept the information given by the Harwell management, but please be mindful of our information too, just to get some sort of balance.

8 If you wish to contact us to discuss issues further, please write to:

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2). UKAEA Harwell Reactor Closures.

a). The issue of safety.

9 Much has been said about the current condition of the materials testing reactors at Harwell, and many replies by the UKAEA have stressed the safety of the reactors. As a defence the UKAEA always hold up the safety audit conducted by the Nuclear Installations Inspectorate (NII). The true facts about this can never be known however, because the findings of the audit remain secret. Only those involved, the UKAEA, the NII and the Department of Energy ever received copies of the report. Until the report is made public, and with the reactors now closed what possible motive can there be for keeping it secret, the public will never know the truth.

10 The most detailed report on safety issues which is in the public domain is a report on reactor safety by the UKAEA, produced in July 1987. Members should ask Harwell for copies of this report before the meeting. If Harwell will not oblige, Banbury Environmental Research will send you one for a small charge.

11 At this early stage I should point out that almost all information we have on reactor safety covers the DIDO and PLUTO reactors. Information on the GLEEP reactor is very hard to come by, and it is not known to what extent the NII safety audit assessed the condition of GLEEP. The NII are however currently assessing the safety case for the GLEEP reactor. Members should ask for further detailed information on the condition of the GLEEP reactor.

12 The UKAEA's July 1987 report details the condition of the materials testing reactors at that time, and a series of modifications which were to be carried out on the reactors to improve safety. As revealed at last years Local Liaison Committee meeting, during the time in which the seventeen modifications to these reactors were to be made, only five were completed.

13 At the time of that report and right up to the present day, the UKAEA were not subject to the requirements of the Nuclear Installations Act, 1965. The UKAEA were required by ministerial direction to have regard as far as practicable to any current safety requirements ordinarily imposed by the Nuclear Installations Inspectorate on other reactor operators in the UK. All safety was regulated within the authority itself with very little intervention by the Nuclear Installations Inspectorate. Much is made of the two outside members on the Harwell Safety Committee which gave the clearance for operation of the reactors, but in truth these external members were in fact scientists retained by the UKAEA on a consultancy fee.

14 The case of whether the reactor were safe or unsafe will, in the current state of things never be known. Until the UKAEA release the relevant information on the safety cases for the reactors, and until the NII publish the findings of the Harwell safety audit, the matter will never truly be laid to rest. The closure of the reactors is therefore to be welcomed. The UKAEA should now publish the specified information, not to judge the safety of the reactors, but to assess whether or not the trust put in the UKAEA by successive governments was in fact abused, and the safety of the public was put at risk.

15 Further detail on the safety of the reactors is covered in section 2(d).

b). Operator Doses.

16 Dr Martin Gardner's report on the incidence of leukaemia around Sellafield has a significant bearing on the health of those working in the reactor area at Harwell. Some workers in the reactor area have over the years received significant doses of radiation. Employers are required to keep radiation doses *As Low As Reasonably Possible* (ALARP). In practice this means that if, on a cost benefit analysis, a certain modification will produce a certain decrease in dose to workers, then that modification should go ahead. There are doubts however as to the lengths the Harwell management went to to implement this policy. I will give three examples.

17 **i). Small Sample Handling Cell.** - this was a lead shielded box with a 6" lead glass window positioned over the reactor whilst it was running. The operator then handled specimens inside the reactor using manipulating tongs, whilst viewing through the window. In 1985 the Design Dept of the Reactor Research Division at Harwell came up with a new design of view cell which would give a lower dose to operators. By using remote viewing cameras, it would not be necessary for the operator to position himself directly over the opening in the reactor, and consequently the dose from gamma and neutron sources was reduced. Tenders for this project were sought in 1985, and the cost of the project was put at around £90,000. However, in May 1986 the Head of Operations instructed that all work on the replacement view cell cease, on the grounds that insufficient funding existed for the project.

18 **ii). Plant Room.** - The reactor plant room is situated directly beneath the reactor. Once a month at shutdown it was often necessary to conduct maintenance work in the plant room, especially to the three heavy water pumps. This work involved a high degree of exposure, especially in the DIDO reactor where in 1982 the primary circuit of the reactor had become contaminated with radioactive materials. Again the Design Department came up with a scheme to replace the pumps with new ones, at a total cost of £250,000 per reactor. This would have meant that the need for maintenance would be significantly reduced, and consequently the dose to maintenance workers. This proposal was rejected by the Harwell management.

19 **iii). Reactor Control Rooms.** - The control rooms for the reactors were situated in

the same room as the reactor itself. The operators were therefore exposed to radioactivity from airborne gases, radioactivity given off directly by the reactor, and from radioactive particles deposited in the building. Occasionally the activity rose to such a level that the control room was temporarily evacuated. This again had significant safety implications. A scheme was devised to site the control rooms outside the reactor building costing around £1.4 million, and in fact the UKAEA's 1987 safety review listed this as being necessary. It was however never carried out.

20 The Gardner report identified that there was a significant chance of genetic defect occurring in the workers offspring of his radiation exposure was greater than 100mSv (milliSieverts), or exceeded 10mSv in the six months before conception. Currently the maximum permitted dose to workers in any one year is 50mSv. The National Radiological Protection Board (NRPB) advised recently that this should be reduced to 15mSv, but this has not yet been implemented.

21 A significant number of workers in the reactor area at Harwell have received doses over this 10mSv figure, and also in excess of the new 15mSv maximum dose suggested by the NRPB. The figures are as follows:

Year	1982	1983	1984	1985	1986.
Exceeding 15mSv.	99	98	61	54	35
Exceeding 50mSv				1	

22 It can be questioned whether an organisation the size of the UKAEA is properly administering the ALARP principle. The actions of the Harwell management in refusing the above and other improvements to the reactors and associated plant makes their full commitment to ALARP doubtful. Though the above figures do indicate a reduction in dose to operators, you must consider this in terms of the small number of people who work in active areas at Harwell. The CEGB and BNFL, per number of radiation workers, do much better than Harwell.

23 With the imminent reduction of the maximum permitted dose, and the evidence from the Gardner Report, it is important that the UKAEA should produce significant reductions in the doses to its workforce. A large dose reduction has already been achieved - with the closure of the materials testing reactors DIDO and PLUTO. However, attention should be paid to getting dose down to safer levels on other parts of the site. Unions representing radioactivity workers are already asking for a dose level of 10mSv, and this does seem sensible as a target to work towards.

c). Emergency Planning.

24 With the closure of the materials testing reactors, emergency planning measures, both on and off-site, will need to be reassessed. This opportunity should be grasped and exploited to ensure that emergency plans are drawn up which reflect incidents which have a

strong probability of occurrence.

25 The previous emergency plan was based on a reference accident which was not likely, and which did not reflect the scale of action which would need to be taken should a serious accident with the reactors at Harwell have happened. The EC body concerned with nuclear energy, EURATOM, has just issued a directive on emergency planning, which all EURATOM members should comply with by November 1991. This lays down minimum requirements for emergency planning, and for the distribution of information to the public. Currently the Health and Safety Executive are looking at how to implement this directive before December 1991. The Atomic Energy Authority should take the initiative, and with the Health and Safety Executive, implement fully this new directive when drawing up new emergency plans for the site. This will mean that plans will not need to be redrawn next year too.

26 The members should pay special attention to the emergency planning measures produced by the UKAEA. Those that were being drawn up to cover the materials testing reactors were particularly lacking. Should a serious incident have occurred with one of the reactors, the plans would have underestimated the true scale of the incident by a factor of 10. The reason for this was that the UKAEA had chosen a particularly limiting reference accident on which to base the whole emergency plan. If the reference accident underestimates the problem, or is not an accurate reflection of a probable incident, then the whole emergency plan will reflect this. The Harwell management should be urged to create an accurate and relevant reference accident.

d). Atomic Energy Authority Position.

27 In December 1988, the UKAEA's publication, "ATOM", carried an article about the testing of AGR fuel rods in the PLUTO reactor. This programme of experiments was scheduled to take place over a period of seven years. However, in February 1989, it was

announced that PLUTO would close in March 1990. The reason for this would be apparently that the PAT loop experiment which was to be used in PLUTO was too dangerous to operate inside the reactor. Without the PAT loop and the AGR contract, PLUTO had no future. When the shutdown was announced though, no mention of the PAT loop or the problems associated with it were made.

28 From December 1987 to January 1988, The Health and Safety Executive's Nuclear Installations Inspectorate (NII) conducted a safety audit of the United Kingdom Atomic Energy Authority's Harwell Materials Testing Reactors, DIDO and PLUTO. In January 1990, the UKAEA's magazine 'ATOM' (no. 399) published an article reviewing the structure of the safety audit, and commenting on the safety of the two reactors.

29 The article not only presented an incomplete version of the safety status of these two reactors, it also made the sweeping statement that "the results showed that the reactors are in a good condition and are operating satisfactorily". This is the UKAEA's own opinion, and not that of the NII - the NII at that time were still considering the safety case for the operation of the DIDO reactor with a view to the licensing of the reactor in early 1991. They had not yet commented whether or not the reactor was fit to continue operating.

30 Throughout the article the UKAEA stress the safety of the reactors, and twice state that the reactors are in good condition and operating satisfactorily. This is not an accurate reflection of the actual situation. The reactors had an original design life of twenty-five years. DIDO would have shortly been coming up for its thirty-fourth birthday. The original design power was 10MW(thermal). This has been steadily updated to the current 25MW(thermal). Parts of the primary circuit are suffering from wear, and some of the drain lines from the reactor vessel has suffered pinhole leaks. The shield cooling coil connections have leaked water for 15-20 years, and the current state of these leaks was not made clear. *Is this satisfactory operation?*

31 The safety of these reactors is for the NII to decide, not for the UKAEA. The NII were still considering the safety cases for the DIDO reactor when this article was published. Until the NII give their deliberation on the issue, as our national organisation charged with the safety of nuclear installations, the the UKAEA cannot state that the reactors are safe.

32 Before the NII had completed assessment of the safety case for the DIDO reactor, the UKAEA announced that DIDO would close on the same day as PLUTO, March 31st 1990. It would seem then that the UKAEA had, by their own accounts, a perfectly safe reactor which for economic reasons they were to shut down and decommission. Does this make sense?. *If the reactor plant were safe, but its continuous running was too expensive because of lack of work, wouldn't it be more sensible to keep it in mothballs until more work came along?.*

33 The truth of the fact is that the DIDO reactor did not meet the standards necessary for approved operation. The result of the NII's deliberations was that the reactors were safe to operate for a limited period, on the condition that certain improvements in plant and safety procedure are met. The UKAEA does not have the funds necessary for the refurbishment of the reactor, and thus closure on 'economic reasons' was the only course they could take. This is not an inaccuracy on the UKAEA's part, it is a statement that they do not have the funds available to bring the safety of the reactor to the standard necessary for NII approval. Why will they not admit this?.

34 The 'ATOM' article describing the safety audit of the Harwell reactors is very informative, but it glossed over many of the more serious points which must be considered when looking at the future operation of the reactors. As described in the reports to the Commons Select Committee on Energy, there are many flaws in these reactors which compromise safety, and these should also have been looked at. Lack of diversity in control systems, operator doses, and the use of pressurised experiments in an unpressurised reactor were not considered in the article, but are an intergral part of the safe operation of the reactors. Consideration should also have been given to the containment building itself. Contrary to the position maintained by the UKAEA, the reactor building was the only total containment enclosure. The primary circuit extends outside the reactor biological shield, and therefore, the reactor itself cannot be considered as the primary containment as it is possible for materials from the core to easily pass through the primary circuit before escaping. The integrity of the reactor building itself was therefore of primary importance. This also has implications for decommissioning.

e). Reactor Closure.

35 The closure of DIDO and PLUTO should not be looked on as a setback to the Harwell laboratories - it is a significant improvement in the safety of the site and it will also create a significant cut in the radioactive airborne and effluent discharges. The condition of the reactors was very poor, despite what the UKAEA claim. If they were in as good a condition as has been stated, why didn't the Nuclear Installations Inspectorate pass them with a clean bill of health, both at the safety audit in 1988, and the further safety case assessments in 1989/90?.

36 There are however three drawbacks to the closure of the reactors. Firstly there is the loss of jobs on site, but as many people in the reactor area were being given very high doses of radiation it could be the case that many of them could be better off health wise. People with the technical skill like those who work at Harwell seldom remain out of jobs for long anyway.

37 Secondly, there is the problem of decommissioning. This will be covered later.

38 Finally, and most immediately, there are the problems associated with the removal of fuel rods from the reactors. When a fuel rod is removed from a reactor it must be cooled in the fuel pond for a period of a few months. After this time it is safe for transport. The fuel pond at Harwell is not very large, and there may be problems keeping the fifty fuel rods from the reactors whilst at the same time keeping the possibilities of accidental criticality, etc, to a minimum. This is especially true of the highly enriched fuel rods used by these reactors.

39 We could be faced with the possibility of having some or all of the fuel rods left in the reactors for a period of months to cool off before removal. If the fuel pond is not large enough to safely accommodate all the fuel rods then leaving them in the reactors would be the safer method of storage. The exact position regarding space in the fuel pond, and the storage of the fuel rods, should be revealed by the Harwell management.

40 Transport of these fuel rods to Dounreay should also be made clear. For many years they have been sent from Harwell to Dounreay, in Northern Scotland for reprocessing, by road. This is statistically the most dangerous way to transport them. Also, the flasks used to carry the fuel rods can only accommodate very small numbers, and there will have to be a number of these trips to transport all of the fuel rods. This is totally ridiculous when you consider that only a small distance away at Didcot there is a rail terminal, and the UKAEA have their own railhead at Dounreay. Transport by rail is statistically much safer, and has always been the preferred method of transport for fuel rods in the UK. Harwell should be urged to transport the fuel rods by rail as the safest option available.

3). Decommissioning.

a). The Harwell MTR design.

41 The DIDO reactor is the oldest of the two (MTR's). The design was based on the US Atomic Energy Commission's CP5 reactor, and it was commissioned in Aug/Sept. 1956. The reactor is heavy-water (D₂O) cooled and moderated and uses 25 fuel rods made from a sandwich of aluminium and 93% enriched uranium.

42 The reactor vessel itself is a cylindrical tank 2m in diameter, the thickness of the

wall at the dished base is 0.5" and the side walls are 5/8". It is made from pure aluminium. The 25 fuel rods are laid out in the centre of this tank. A number of openings and thimble-tubes give access close to the core for experiments. Outside the reactor vessel is the graphite reflector made from machined graphite blocks and is around 60cm thick. The core is encased around the side and bottom by a double walled steel tank 10' 10" in diameter and 9' high. The top of the core is capped by a hollow steel plug 2' 9" thick, the void inside is filled with concrete. On the lower side of this plug are two steel plates with a layer of lead and a layer of cadmium sandwiched between them. This plug rests just above the reactor vessel, and holes allow access for experiments and fuel rods. The double walls of the steel tank are filled with a layer of lead through which run copper pipes carrying distilled light water coolant. Outside the steel tank is the concrete biological shield, an irregular decagon 22' across and 19' high. This is faced on the outside by steel, and the minimum thickness of the biological shield is 5'. The whole structure is supported on a grid of steel joists encased in the concrete of the biological shield resting upon four steel legs which run down to ground level. This provides clearance below the reactor to accommodate the plant room. The plant room houses three heavy water pumps, heat exchangers, and the D₂O storage tank. The three heat exchangers cool the D₂O with light water. This is then pumped to eight cooling stacks outside the building.

43 The reactor building itself is made from welded preformed sheet steel. This is reinforced by vertical channel sections running up the sides and over the roof of the building. The building is around 70' in diameter, and is roughly the same height from base to the tip of the roof.

44 The design of the PLUTO reactor varies only in the layout of the experiment holes in the core, and the supports for the reactor. Other than this there are few differences.

45 The small size of these reactors, and their method of construction (on raised platforms) makes the whole process of decommissioning very simple as all side of the reactor are accessible, and therefore the construction of a barrier around the reactor to ensure the long term safety of the core is a very simple matter. Also ***the size of the steel reactor vessel is such that after a period of fifty or so years, disposal without the need to break open the core is possible.***

b). Stages of Decommissioning.

46 The process of decommissioning has only been properly studied in the past decade or so. However, certain stages have been identified. The first stage involves removing the fuel rods and parts of the reactor plant contaminated to a low level of activity. In stage two the core is encased in a sarcophagus - concrete and other barrier layers to prevent the escape of radioactivity from the core. The high levels of radioactivity will take quite a few decades to decay to safe levels, and so the integrity of the reactor over this period is very important. This is the reason for the sealing up of the reactor - to prevent the movement of radioactivity out of the core or the movement of water, etc, into the core. In the third and final stage, the core itself can be dismantled and disposed of as intermediate level waste.

47 It is important to realise that the core of the reactor must be kept in the best possible condition for the stage two period when activity within the reactor is allowed to decay. It is not simply a matter of sealing the core, and then walking away and leaving it for X years. The reactor and the building it is situated within must be carefully monitored over this time to ensure that there is no movement of activity from the core. Regular maintenance must also be carried out to the sarcophagus and surrounding building, to ensure that the ingress of water from the environment is not possible. Security is also another factor which needs to be organised over this long period.

c). The future for the Harwell reactors.

48 When considering decommissioning, we should not just be thinking of the DIDO and PLUTO reactors. There have been many experimental reactors operating on the Harwell

site since the late 1940's, and though most of these were zero power reactors which were dismantled straight away, there are some larger reactors on site which give cause for concern. For instance, what has happened to the BEPO and LIDO reactors?. Have they been properly decommissioned, or have they just been left without any proper precautions being taken to ensure the safety of the local environment.

49 It is true that no major threat to public safety is being posed by the smaller reactors, but if they are not properly sealed, maintained and monitored there is the risk of radioactivity contaminating the local soil, which of course will create problems if at a later date the whole area is returned to a 'greenfield site'. At the same time as embarking on a major decommissioning project on the materials testing reactors, the condition of these other reactors also needs to be assessed.

50 In March this year the DIDO and PLUTO reactors shut down. This was announced by Harwell in February. However, since then information has come to light which casts doubt on what form the decommissioning of these reactors will take.

51 In a letter from the director of UKAEA Dounreay (which has a reactor almost identical to PLUTO, which closed in 1969), to Robert Maclennan MP it states that the decommissioning of PLUTO will only be taken to stage 1 - the removal of the fuel rods. Exactly the same measures were applied to that reactor too - after the removal of the fuel rods the building was locked up, and no further action to decommission it was taken.

52 The Harwell press release of February 1989, which announced the closure of the PLUTO reactor, stated that, 'staff would be redeployed to other work or retained for decommissioning work', and went on further to say that, 'the closure of PLUTO will provide Harwell with opportunities to develop further its expertise in decommissioning nuclear plant'. If it is the case that decommissioning will only be taken to stage 1, then the whole process should take around 3 weeks, and would in fact need no more experience than is currently used during regular fuel changes.

53 A letter from the Atomic Energy Authority in London states that after closure

experiments and other equipment will be removed, and all services will be capped and sealed. How effective this will be is questionable as it has already been admitted that the reactor has suffered internal corrosion over its operating lifetime, from leaks in the light water cooling circuit. The effectiveness of merely sealing off all the openings to the reactor can therefore be questioned. If the reactor itself is weakened in any way it could present an avenue for the escape of activity from the core?. The DIDO reactor has been in place for 34 years. It will have to remain for another 50 years. Can its integrity be guaranteed over this timespan?.

54 To ensure the safety of the materials testing reactors, they should be encased in a properly constructed reinforced concrete sarcophagus. This will ensure that the movement of activity, by whatever route, is stopped, and it will also provide additional security over the coming years. As stated the reactors are raised up and so sealing them in an enclosure will not be problematic. Harwell should be urged to do this as it will at a stroke provide a high level of security against the movement of radioactivity into the environment, be it accidental or deliberate.

55 If the site is to be returned over time to 'greenfield' open space, it is important to get things right at this stage. Effective decommissioning of the redundant plant on the site must start now. This means not just the materials testing reactors, but also all other redundant nuclear plant, and other redundant parts of the site which use toxic chemicals. By investing in the proper technology now, we will reduce the need for costly clean-ups later on. You must bear in mind that some parts of the site, even if decommissioned this year, will not be safe for dismantling and disposal to well into the middle of the next century. Do we want to leave the problem to the next generation?.

4). Other Issues.

a). Groundwater pollution.

56 It has recently come to light that chlorinated hydrocarbons have been found in the water supply around Harwell. This water comes from boreholes which feed from an aquifer which runs under the Harwell site. At the moment information is limited and we are still looking into the problem, but certain things can be said at this stage.

57 On March 23rd, an article appeared in the '*Guardian*' newspaper which reported that the National Rivers Authority had found chlorinated hydrocarbons, carbon tetrachloride and chloroform in the groundwater supplying the village of Blewbury. It was stated that the water in Blewbury was safe to drink, but that levels of contaminants in the same aquifer around Harwell were much higher and the extent of contamination was being investigated.

58 The geology of the area is Greensand overlaying chalk. Harwell have in the past commissioned geological surveys of the area to determine the likely spread of contamination from the low level radioactive and toxic waste dump on site, and so an extensive knowledge of the Cretaceous geology of the area is already possessed by Harwell. These reports are not openly available, but can be found in the Harwell library. These surveys have found that diagenesis has caused increased porosity of the Upper Greensands, Upper Gault and parts of the Lower Chalk, and that later fracturing and jointing of the rocks has created pathways for water movement. Put simply, this area has very porous rocks below the surface which conduct water, and thus any pollutants in the surface-water feed relatively quickly down to the underlying chalk and the deep aquifers which are tapped for drinking water.

59 There are three possible sources of contamination which we have information on. Firstly, and the most probable source, is the landfill dump which has been used for some thirty years. This has been used to dump low level radioactive wastes and unknown toxic wastes. There have been a number of problems with this site over the years. For instance to keep down the level of surface activity from the radioactive wastes, soil was often dumped over the top of the site. However, due to the action of water percolating down through the

wastes in this dump, and thus on through the Greensand to the chalk below, this could be identified as one of the primary pollution sources.

60 Secondly there are the drains on site. Each building on the site has a drain leading to the tank farm where all liquid effluent is treated. Leaks from these drains have been found from time to time, the most serious being a leak of effluent containing Plutonium. This incident was later investigated by a special Committee of Inquiry chaired by the site director. It is possible that small amounts of liquid effluent, containing high levels of some solvents and chemicals, have leached into the surrounding soil, and could have been carried down through to the local aquifer by rainwater.

61 Finally, there is the waste pipeline which discharges into the Thames at Sutton Courtney. This would not be a very likely source as the levels of solvents and other chemicals in the effluent would be quite low - otherwise the pollution would show up in the Thames before any effect on groundwater would be noticed. However contamination from this pipeline could be a contributing factor for two reasons. Firstly the pipeline is quite old, and has suffered a number of leaks, especially over recent years. Secondly, to prevent air lock effluent is always kept in parts of the pipe. For this reason also it is hard to calculate the rate of leakage from the pipeline because, whilst effluent remains in the system, it is impossible to accurately account for the amounts flowing in and flowing out. When leaks are detected therefore, they are usually very large.

62 More investigation of the contamination of the local aquifer by solvents and other chemicals is needed. For instance, the time delay between when these chemicals were released and when they reached the aquifer needs to be assessed. This may not be as hard as it sounds. If the waste dump is the source then radioactivity will be present. Thus the levels of different radionuclides, because of their different decay times, could be used as indicators. If the time delay could be determined, it would be possible to fix a date for when leaching started, and thus assess the possible levels of contamination by looking at what has been dumped in the landfill around that time.

b). Intermediate waste.

63 It is widely known that barrels containing intermediate level radioactive waste are stored at Harwell. Many of these barrels have been in store since 1983, and as stated by Harwell in a letter some time ago, the design and construction of these barrels gave no thought to their retention capability.

64 It has been stated that the repackaging these barrels cannot be justified because of the dose which would be incurred by the workers. If these barrels were to be soon sent to the NIREX repository then this would be true. However, the International Atomic Energy Authority has just criticised NIREX's repository design and proposed construction methods. Coupled with the problems with the test bores at the two possible sites for the repository, the completion date for the project may be put back many years. This leads us to the question, how much longer will these barrels be stored here?.

65 If these barrels are to be stored here for a very long time to come, serious consideration should be given to repackaging the drums - especially the older sea-dump drums. Over this time, due to corrosion and seepage, many of these barrels will have to be over-packaged. I believe some have been so already. Surely in terms of risk and dose to workers, it is more sensible to repackage a drum before it starts leaking, rather than after it starts leaking and the surface and surrounding area has been contaminated?

66 It is true that the slow leakage of material from these barrels would not be at such a rate to endanger anyone beyond the perimeter of Harwell, but contamination of the local soil with long live radionucleides is possible. This would have an effect for the reuse of land in the future. Before the storage of these barrels become a problem, their future should be assessed and action taken now to avert any anticipated problems.

c). Ministry of Defence involvement.

67 Harwell has been involved with the research programmes of the Ministry of Defence in many areas. For example the DIDO Water Loop tested fuel rods for the Polaris submarine reactors, and Building 220 conducts research to assist AWE Aldermaston - including the machining of Plutonium.

68 It is a fact that Building 220 handles Plutonium, the storage and handling being governed by International Atomic Energy Authority and EURATOM regulation. These safeguards have been developed by the IAEA/EURATOM Safeguards Research and Development Group, and are intended to ensure safe handling and prevent the possible misuse or loss of Plutonium. Whenever the AEA handle Plutonium, at Harwell or anywhere else, it must adhere to these safeguards.

69 Recently, the Director of the UKAEA's Nuclear Materials Control Office, stated that Harwell handles nuclear materials outside the IAEA/EURATOM safeguards. He did add however that nuclear materials are only very seldom 'taken out of safeguards' because the Department of Energy didn't like it.

70 The question should be put as to why it is necessary to take these materials outside safeguards and for what reasons and on how many occasions this has occurred. Why is it necessary at a civil atomic establishment for highly dangerous materials such as Plutonium to be taken out of regulations designed to ensure their security?. *By security I do not mean the chances of theft, but rather ensuring that, for the purposes of international agreements governing the movement and use of fissile materials, such materials are not secretly hidden or passed to third parties.*

71 There is also the question of how Plutonium is transported to the establishment. Normally it is moved in its natural oxide state - this being the safest method. However, I cannot find any evidence that Harwell has a Plutonium smelting facility, and therefore we must assume that it arrives in its pure metal state. How therefore, if Harwell has no smelting facility, is its safety ensured, and is its storage and transport subject to civil or military safeguards?.

5). The future for atomic research.

a). The GLEEP reactor.

72 Now that the DIDO and PLUTO reactors have closed, the GLEEP reactor is the last

reactor operating on site. GLEEP is a small reactor, commissioned in 1947. It is graphite moderated and air cooled, with a power rating of around 300kW. Very little information is available as to the current condition of this reactor.

73 Currently the Nuclear Installations Inspectorate are considering the safety case for the GLEEP reactor as part of the licensing procedure for the site. The current stage of this is not known, or what possible recommendations the NII will make as to the future of GLEEP. The scale of work GLEEP performs, without the backup of the MTR's, is limited. Therefore its future is uncertain. It may close shortly before the lifting of the AEA's exemption from the Atomic Energy Acts, should it not receive clearance from the NII or the cost of improvements proves too great.

b). Possibilities for a new reactor.

74 At the same time as announcing the closure of the materials testing reactors, it was announced that there was a possibility that a new reactor could be built on the site. Support for a new reactor was also voiced by the local MP. However at the moment the chances of a new reactor being built on the site seem very remote.

75 The nuclear programme in the UK has been frozen until 1994 - no decisions on new reactors will be taken until that date. This coincides with the rundown of the Polaris submarines and the consequent lack of research needed to maintain the submarine's nuclear power plants. At the moment therefore, a research reactor is not needed. The other work conducted by these reactors, such as the doping of silicon and production of isotopes, can all be done at other European research reactors and therefore there is no urgency for new a reactor in this area either.

76 In the current climate, there is no urgent need for a new research reactor. Even if it is decided that there is a need, it may be that Harwell is not chosen to take the new reactor. This is also the position taken by the UKAEA in London, and the Department of Energy. No firm decision will be taken until the future of the nuclear industry in the UK has been sorted out. Any reference to the building of a new reactor at Harwell has no sound basis.

6). Summary, Recommendations and Questions.

77 This year will see two major blows to AEA Technology - the division of the Atomic Energy Authority which run Harwell. Firstly there is the closure of the materials testing reactors, DIDO and PLUTO. This will have a major impact on the scope of research capable on the site, especially on the nuclear side. Secondly there is the loss of their exemption to the Atomic Energy Acts. This again will affect how the operations on the site are carried out. The involvement of the Nuclear Installations Inspectorate in the running of the plant will increase, and this could mean, as in the case of the DIDO reactor, the closure of some parts of the plant.

78 Much has been said about the current condition of the materials testing reactors at Harwell, and many replies by the UKAEA have stressed the safety of the reactors. As a defence the UKAEA always hold up the safety audit conducted by the Nuclear Installations Inspectorate (NII). The true facts about this can never be known however, because the findings of the audit remain secret. Only those involved, the UKAEA, the NII and the Department of Energy ever received copies of the report. Until the report is made public, and with the reactors now closed what possible motive can there be for keeping it secret, the public will never know the truth.

79 The truth is that the DIDO reactor did not meet the standards necessary for approved operation. The result of the NII's deliberations was that the reactors were safe to operate for a limited period, on the condition that certain improvements in plant and safety procedure are met. The UKAEA does not have the funds necessary for the refurbishment of the reactor, and thus closure on 'economic reasons' was the only course they could take. This is not an inaccuracy on the UKAEA's part, it is a statement that they do not have the funds available to bring the safety of the reactor to the standard necessary for NII approval. Why will they not admit this?.

80 The case of whether the reactor were safe or unsafe will, in the current state of things never be known. Until the UKAEA release the relevant information on the safety cases for the reactors, and until the NII publish the findings of the Harwell safety audit, the matter will never truly be laid to rest. The closure of the reactors is therefore to be

welcomed.

81 Dr Martin Gardner's report on the incidence of leukaemia around Sellafield has a significant bearing on the health of those working in the reactor area at Harwell. Some workers in the reactor area have over the years received significant doses of radiation. It can be questioned whether an organisation the size of the UKAEA is properly administering the ALARP (*As Low As Reasonably Practicable*) principle. The actions of the Harwell management in refusing simple improvements to the reactors and associated plant makes their full commitment to ALARP doubtful. Though the figures do indicate a reduction in dose to operators, you must consider this in terms of the small number of people who work in active areas at Harwell. The CEGB and BNFL, per number of employees, do much better than Harwell.

82 With the imminent reduction of the maximum permitted dose, and the evidence from the Gardner Report, it is important that the UKAEA should produce significant reductions in the doses to its workforce. A large dose reduction has already been achieved - with the closure of the materials testing reactors DIDO and PLUTO.

83 With the closure of the materials testing reactors, emergency planning measures, both on and off-site, will need to be reassessed. This opportunity should be grasped and exploited to ensure that emergency plans are drawn up which reflect incidents which have a strong probability of occurrence. The previous emergency plan was based on a reference accident which was not likely, and which did not reflect the scale of action which would need to be taken should a serious accident with the reactors at Harwell have happened.

84 The EC body concerned with nuclear energy, EURATOM, has just issued a directive on emergency planning, which all EURATOM members should comply with by November 1991. This lays down minimum requirements for emergency planning, and for the distribution of information to the public. Currently the Health and Safety Executive are looking at how to implement this directive before December 1991. The Atomic Energy Authority should take the initiative, and with the Health and Safety Executive, implement fully this new directive when drawing up new emergency plans for the site.

85 The small size of these reactors, and their method of construction (on raised platforms) makes the whole process of decommissioning very simple as all side of the reactor are accessible, and therefore the construction of a sarcophagus around the reactor to ensure the long term safety of the core is a very simple matter. Also the size of the steel reactor vessel is such that after a period of fifty or so years, disposal without the need to break open the core is possible.

86 It is important to realise that the core of the reactor must be kept in the best possible condition for the period when activity within the reactor is allowed to decay. It is not simply a matter of sealing the core, and then walking away and leaving it for x years. The reactor and the building it is situated within must be carefully monitored over this time to ensure that there is no movement of activity from the core. Regular maintenance must also be carried out to the sarcophagus and surrounding building, to ensure that the ingress of water from the environment is not possible. Security is also another factor which needs to be organised over this long period.

87 We could be faced with the possibility of having some or all of the fuel rods left in the reactors for a period of months to cool off before removal. If the fuel pond is not large enough to safely accommodate all the fuel rods then leaving them in the reactors would be the safer method of storage. The exact position regarding space in the fuel pond, and the storage of the fuel rods, should be revealed by the Harwell management.

88 Transport of these fuel rods to Dounreay should also be made clear. For many years they have been sent from Harwell to Dounreay, in Northern Scotland for reprocessing, by road. This is statistically the most dangerous way to transport them. Also, the flasks used to carry the fuel rods can only accommodate very small numbers. Therefore there will have to be a number of these trips to transport all of the fuel rods. This is totally ridiculous when you consider that only a small distance away at Didcot there is a rail terminal, and the UKAEA have their own railhead at Dounreay. Transport by rail is statistically much safer, and has always been the preferred method of transport for fuel rods in the UK. Harwell should be urged to transport the fuel rods by rail as the safest option available.

90 *The closure of DIDO and PLUTO should not be looked on as a setback to the Harwell laboratories - it is a significant improvement in the safety of the site and it will also create a significant cut in the radioactive airborne and effluent discharges. The condition of the reactors was very poor, despite what the UKAEA claim. If they were in as good a condition as has been stated, why didn't the Nuclear Installations Inspectorate pass them with a clean bill of health, both at the safety audit in 1988, and the further safety case assessments in 1989/90?.*

END.

There are a number of issues which need to be addressed by the Harwell management concerning the organisation and the future of the site. There is speculation about many aspects of the work carried out on the site. The only way the public can be assured is by the Harwell management releasing more information about what is happening on the site. Appended to this report are a wide range of questions on a number of issues. Getting answers to these questions would be a significant step to improving confidence in Harwell.

- 1). Will Harwell ask the Nuclear Installations Inspectorate to publish the findings of the Harwell MTR Safety Audit, and the initial deliberations of the NII inspectors on the safety cases put forward for the DIDO reactor?. Also, will Harwell arrange for this information to be passed on as quickly as possible to other countries who operate similar designs of reactor? - eg, the Australian Atomic Energy Commissions HIFAR reactor.

- 2). Will Harwell immediately compile and make public a detailed statement on the current condition of the GLEEP reactor, and the current condition and future of the BEPO, LIDO, and other decommissioned reactors remaining on site?.

- 3). Will Harwell produce a detailed timetable for the decommissioning of all active plant on site, and make this document public?. This should include detailed information on the way the plant will be dismantled, information on the long term storage of any highly active parts of the plant, and also information as to the final disposal route for all active plant.

- 4). If the reason for closing the DIDO reactor was lack of funds, and yet the reactor was, as stated by the UKAEA, in sound condition, why was the decision taken to close, and not mothball, the DIDO reactor?. Was the DIDO reactor closed because the UKAEA could not afford the investment necessary to bring these reactors up to the standard required by the NII?.

- 5). Will the UKAEA commission a detailed programme of checking and replacement/refurbishment of the waste pipeline to the Thames to ensure that spillages cannot take place in future?. Also, as part of this programme, will the UKAEA install equipment to give an accurate reading of the input to and output from the pipeline so that losses can be detected?.

- 6). How much Plutonium is stored on site, and to what standards (MoD/IAEA) is it kept. Also, is Plutonium brought to Harwell in an oxide or metal state?
- 7). Has Plutonium kept at Harwell been taken out of safeguards, how many times has this taken place, how much Plutonium was involved, and what was the reason for taking this action?.
- 8). Will the UKAEA and the Harwell management give an assurance that Plutonium will not be taken out of IAEA safeguards ever again?.
- 9). Do Harwell carry out R&D work for AWE Aldermaston or other MoD facilities, and does this work involve the use or machining of Plutonium.
- 10). Will Harwell work to a maximum annual dose to radiation workers of 10mSv, as outlined in the Gardner report and as has been requested by some trades unions?.
- 11). Will Harwell, whilst re-drawing the emergency plans for the site in consultation with local authorities etc, take account of the new EURATOM directive on emergency planning, and implement its requirements fully?.
- 12). Are the DIDO and PLUTO reactors going to be sealed in proper concrete enclosures to ensure the best possible safety of the cores whilst fission products are allowed to decay? . If not, would the Harwell management give a detailed statement on the exact steps which are to be taken in the sealing of these reactors to ensure that their integrity is ensured for at least fifty years?.
- 13). Are all the fuel rods from the two MTR's now in the fuel pond, how long will they be remaining there, and when is it envisaged that the fuel pond can be closed and dismantled?.
- 14). Will the fuel rods from the Harwell reactors be transported to UKAEA Dounreay by road, or by rail? . If they are to be transported by roads, could reasons be given to support this?.

15). Will the UKAEA now consider repackaging all intermediate waste on site in containers designed for above ground storage, now that the UK Deep Repository project has been set back for perhaps another 10 years or more?.

16). Would the Harwell management consider organising occasional tours of the site and discussion of issues of concern for a few representatives of local environmental groups, to reassure the public that all activities on the site were being carried out in a safe manner?.

17). Would the UKAEA agree to one or two representatives being given membership observer status on the Harwell Local Liaison Committee?.

18). Are there plans to build a new Materials Testing Reactor at Harwell, either in the near or distant future?.

19). What is the proposed future operating lifetime of the GLEEP reactor, and could the UKAEA produce evidence to support operation to this date?.

20). Should local groundwater pollution be traced back to the UKAEA Harwell site, what measures are proposed to alleviate the pollution of local groundwater?. Would this include the funding for special filter plant to be installed at local abstraction points, or for the connection of local villages to the mains supply?.