Submission to the

AWE Community Inquiry

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by

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1. Introduction

Oxfordshire Friends of the Earth Network, representing all of the Friends of the Earth groups in the County, wishes to welcome the initiative of Reading Borough Council to examine further the issues surrounding the operation of the Atomic Weapons Establishments at Aldermaston and Burghfield. As part of this examination, we wish to contribute the views of Oxfordshire FoE on these establishments, and submit evidence to show that the effects are not limited to Berkshire alone; the long-standing link between Aldermaston and the Atomic Energy Authority's Harwell Laboratory give rise to risk to residents of Oxfordshire too.

We anticipate that much of the concern expressed at the Inquiry will relate to the use and discharge of fissile at AWE Aldermaston and Burghfield, and the immediate risk these operations present. We would like to broaden the scope of the evidence presented further by the use of an argument often used by the Ministry of Defence in relation to their work at these sites; - that is, that the standards practised at Aldermaston and Burghfield are directed to be as strict as those practised elsewhere in the civil nuclear industry.

Given this assumption, we would like to show that the Aldermaston and Burghfield sites are likely to present a risk to the public through land contamination (both chemical and radioactive), by poor engineering standards in the older parts of the plant which lead to increased risk to the public, and by a cavalier attitude to the decommissioning of plant and the management and disposal of radioactive waste. If we do believe that standards at these establishments are the same as those in the civil sector, the nearest comparable establishment is AEA Harwell, and this facilities suffers all the problems outlined above.

Much of the evidence that follows relates to the older parts of the Aldermaston site, rather than the A90 complex and its associated works. Much of the information has been published in my previous reports on Harwell.

2. The links between AEA Harwell and AWE Aldermaston.

Harwell and Aldermaston are 'two sides of the same coin'; they share a common history until the 1970s, Aldermaston and Burghfield are today run by a management consortium including AEA Harwell, and even after Aldermaston and Burghfield were taken out of the UK Atomic Energy Authority (UKAEA) in 1973 staff were still exchanged between the two facilities.

It was not Aldermaston who produced the plutonium for the UKs first nuclear weapons - it was Harwell[1]. Construction work began at Harwell in 1946, and BEPO (British Experimental Pile) - the first reactor at Harwell, went critical in July 1948. Aldermaston was not taken over for atomic weapons work until 1950, with weapons production beginning in the Summer of 1952. It was during the period 1947 to the mid-1950s that plutonium manufacture and weapons design/manufacture work was carried out.

Even after the severance of Aldermaston and Burghfield during a reorganisation of the UKAEA in 1973, Harwell continued to carry out work, primarily research and development, at its 'hot' laboratory in Building 220. Past interviews with ex-Harwell employees[2] makes it very clear that Building 220, and the work carried on within it, made it an 'establishment within the establishment' - separate security, a nominally separate workforce, and it even has its own 'secure' fence within the Harwell's own secure perimeter.

It is this inseparable link between Aldermaston and Harwell which give us such cause for concern. My work over the past ten years has uncovered many instances of plant being operated in an unsafe manner, without proper regulation by nuclear safety authorities, and there has been little importance given to the management of both toxic and radioactive wastes. If we assume that the practices at Aldermaston are the same as those at Harwell, as has been inferred by the Ministry of Defence and the UKAEA in letters and Parliamentary Answers, then it is highly likely that the same problems exist around that site too.

The links that exist between Harwell and Aldermaston today are four-fold:

i. Aldermaston is run by a consortium of companies, one of whom is AEA Harwell. But even before this 'official' linkage, it was common practice to exchange staff between the weapons and reactor divisions at Harwell and Aldermaston.

ii. Harwell stores civil plutonium, an on occasion this plutonium has been taken out of IAEA safeguards, presumably for military purposes. There are also regular shipments of plutonium and other fissile materials between Aldermaston and Harwell, carried by the MoDs 'Special Materials Transport Group'. Also, because Harwell does not possess (to my knowledge) a plutonium smelter, the transport of plutonium must be carried out in its stable metal state - not as a metal oxide.

iii. In Building 220 at Harwell, to the present day, research work has been carried out on weapons at the 'hot laboratory'. This involves not only 'qualitative' testing of materials, but also the manufacture of weapons parts in Building 220's 'hot' machining facility.

iv. Harwell possesses a 'Special Development Order' which allows it to put up low and intermediate level radioactive waste stores on the site without any need to planning consent, or environmental assessment. According to a source within Harwell, waste from Aldermaston is being transferred to these stores because of problems accommodating it on the Aldermaston site as decommissioning work commences.

To this list we can also add another, now defunct, link. Aldermaston, like Harwell, has a number of small nuclear research reactors operational on site. The last of these, HERALD, was closed in 1986 and all the work was transferred to the DIDO and PLUTO test reactors at Harwell. Shortly after the publication of my report on the safety of these reactors in 1989, the AEA announced that both the the reactors were closing for 'economic reasons'. It is unclear where Aldermaston's research reactor work is now carried out (if at all), but the most likely site is the AEA's facility at Windscale (Sellafield).

The point must be made that the observations which are made in the following pages cannot be proven to have happened at Aldermaston - the information is not available. However, if Aldermaston has maintained the standards kept in the civil sector (e.g., Harwell), then there is no reasons why such occurrences could not have happened at Aldermaston, and I would argue it is up to the MoD to publish irrefutable data to prove it has not.

References.

[1] Statement by Dennis Dawson, the ex-head of the AEA's Reactor Research Division.

[2] Those ex-employees who I have talked to about AEA Harwell are bound by the Official Secrets Act, and at the time of interview I guaranteed anonymity whenever their information was used. For this reason, I would ask the Inquiry to interpret these references as they see fit, given the weight of attributable evidence presented to back them up.

Environmental Problems at Harwell

A. Introduction and Summary

The Atomic Energy Authority at Harwell have, for many years, neglected their responsibility to manage safety and waste disposal policy on the site according to the law and good practice[1]. The most recent manifestations of this lapse in responsibility have been the pollution of the local groundwater aquifer, and the illegal dumping of waste at Sutton Courtenay. I believe that the Harwell management have in the past been extremely negligent in the discharge of their duties - specifically in the safe maintenance of plant and in the disposal of waste materials.

It is highly likely that the Harwell management have deliberately ignored evidence concerning the vulnerability of local groundwater aquifers to pollution from waste deposited in the ground. Now, after that pollution has worked its way into local drinking water supplies, they are trying to play the issue down by insisting that they have the skills and technology to clean it up[2].

The management of Harwell have in the past deliberately flouted safety and environmental regulations[3]. They must be made to keep to the rule of law as the rest of the nuclear industry in the UK.

The situation regarding the unsuitability of the local geology for waste storage was highlighted in surveys of the Harwell site made by the British Geological Survey in the early 1980's. I also highlighted the possibility of material leaking into local groundwater aquifers many times in letters, and in my report on site safety at Harwell in Dec. 1989. All this information appears to have been ignored. If I can comprehend the dangers of the disposal practices on the site, I'm sure that the intelligent and highly qualified men at the AEA could also.

I believe that an investigation into safety and waste disposal on site, similar to that being conducted by Reading Borough Council on Aldermaston and Burghfield, will find that they repeatedly broke the conditions of the waste disposal license issued to the AEA by Oxfordshire County Council, by depositing material likely to cause pollution of the local groundwater aquifer in various parts of the site.

The further examples of the AEA's disregard for the law is their tyre pyrolysis8>. Under the Environmental Protection Act this is a scheduled process which must have the approval of Her Majesties Inspectorate of Pollution (HMIP). It was started up without the approval of the HMIP, and without the local District Environmental Health Department knowing of its existence. I also have a report from inside Harwell (confidential source) that parts of a reactor were dismantled without authorisation from the Nuclear Installations Inspectorate, and so had to weld it back in place again. During this work engineers were exposed to high levels of radiation.

I also discovered that materials had been dumped at Sutton Courtenay for many years with no disposal licence. In a fenced area behind the pumping station at Sutton Courtenay, in an old gravel pit, empty radioactive waste drums had been dumped in the water - presumably to 'cover them up', but during the drought they became exposed. Some are obviously engineered for the encapsulation of highly active wastes. Most of these barrels appear to have been there for ten or twenty years, but there are signs that materials have been left on the site very recently. For example, there are many laboratory flasks, parts of pipework, steel tanks and building rubble strewn around parts of the site.

Most significantly, there is a discharge pipe running from the pumping station to the edge of the gravel pit. This discharges contaminated sediment, most likely from the cleaning of the pipeline discharge, into the gravel pit. This discharge is not mentioned in any AEA documents, and nor was is it included in the most recent application for authorisation to discharge to the HMIP. The 'bottom line' is that Harwell have been discharging materials into this gravel pit for many years without any proper checks taking place by the relevant regulatory authorities.

Radiation measurements which I took around this area showed it to be 25% to 50% more radioactive than the surrounding countryside, and whilst the old waste drums have a very low level of contamination, the new material deposited on the site, and the pipeline discharge itself, give a reading above the level of background radiation.

In the active waste packaging and storage area at the North end of the main site, there is was also evidence of sloppy practice. There were drums containing active wastes, rusting away and with obviously loose lids, less than twenty feet from the perimeter fence, and the public bridleway that runs past at this point. These barrels were not covered, they were exposed to the wind and rain, and according to the figures on them, could have been standing there since 1979. The whole area gave off high radiation readings, and whilst there may not be any major hazard to the public, it is most disturbing to think that Harwell staff work in this environment. To give a comparative example, one hour spent at the perimeter fence gave an equivalent of a whole days 'natural' radiation dose.

I publicised these problems on Central news, and Harwell denied that there was any problem. But in the following six months, all of these sites were cleaned up and, in the case if the active waste area, scrubbed clean.

All in all, past operations at Harwell can best be described as 'sloppy', carried out by managers and scientists who believed that 'they new best' about the risks and method to minimise those risks. The problems I have highlighted show this attitude to be fundamentally flawed.

If we assume, as the MoD would have us believe, that standards at Aldermaston were the same as standard at sites like the Harwell Laboratory, it is highly likely that similar problems will be found there too, if the Government allow an independent and open inquiry.

References

1. The waste disposal license was issues in 1984. That is extremely late - it should have been issued around 1977/8. Even so, following the issuing of this license, drums of chemicals are still being stored where materials can leak into the surrounding soil, and materials, which may pose a threat to groundwater, are being stored around the back of the site.

2. There is not one example of a seriously polluted aquifer being cleaned up anywhere in the world. It is possible to remove a large proportion of the material from the dump, either by direct excavation or by washing out the contamination, but this does not solve the problem of the contaminants now making their way through the deep aquifers.

3. It is doubtful, looking at the existing practices on site, that the AEA fully met the conditions of CoPA 1974. The fact that there was a delay of nine years may indicate the problems the AEA had at Harwell, in tidying the place up, and finding alternative disposal routes for toxic materials. They certainly broke CoPA, and the Water Act, at the Sutton Courtenay gravel pit.

B. Plant safety.

The the materials testing reactors (MTRs) at Harwell, called DIDO and PLUTO, were constructed in 1956 and 1957 respectively. Both are almost identical, and are very similar to the one which was opened at Dounreay in 1958. They were heavy water moderated and cooled, operating at atmospheric pressure and at around 70 degrees Celsius. The original design power was 10MW thermal, but over a long period this was slowly upgraded a number of times to the final level of 25MW. The fuel rods were made of a composite of aluminium and 93% enriched Uranium-235.

Safety at the site was not regulated by the Nuclear Installations Inspectorate. Due to the exemption the UKAEA possessed under the Atomic Energy Acts, safety of all nuclear plant was regulated from within the AEA itself by a safety committee comprising mainly of Harwell employees and employed consultants. Over a period of time this led to a slow deterioration in the condition of these reactors.

During the 70's the reactors had little investment to keep them up to standard. Operator doses were very high, with quite often more than 30-40 people a year exceeding a dose of 15mSv per year[1], and some coming close to, or exceeding, the (then) legal limit of 50mSv set in the ionising Radiation Regulations. Many proposals for improving safety and reducing operator doses were made, but these were dropped due to lack of funds.

The whole history of these reactors is one of short-cuts and under investment in safety systems.

There was a third reactor operating on site called GLEEP which closed shortly after DIDO and PLUTO. It was a small reactor (3kW thermal power) commissioned in 1947. It was graphite moderated and air cooled using natural uranium and oxide fuel. Initially used for isotope production and general neutron physics it was later used for routine graphite/uranium and reactor grade materials testing, operator training and neutron flux calibration. We had no firm evidence relating to the condition of the reactor, dosage to operators, etc. Its swift closure along with DIDO and PLUTO may mean that it was also in an unsafe condition.

The MTRs had a single set of control rods for the primary control and shutdown. A smaller set was used to vary activity to a fine degree, but this secondary set is not able to reduce neutron activity enough to effectively shutdown the reactor. As these reactors were built before the Windscale fire in 1957[2], no emergency secondary shutdown system was fitted to the reactors[3]. Even after the Windscale incident no working system was ever fitted. An engineering fault sequence assessment, to determine exactly how risky it was to operate the reactors, and which could also point out areas for improvements in the system, was never fully conducted either.

Both reactors used highly pressurised, high temperature experiments in the core. Considering that the reactors were not constructed as pressure vessels, and did not have a backup emergency shutdown system, the consequences of failure of one of these pressurised loops could have be very serious. But again, the production and approval of safety cases for each of these experiments was regulated internally, and so many of the experiments did not have to meet the engineering standards required elsewhere in the nuclear industry[4]. The two experiments which gave the greatest cause for concern were two experimental loops used for testing reactor fuel rods.

One of the loops was in the DIDO reactor. This experiment, known as the DIDO Water Loop, was used to test Polaris submarine fuel rods[5]. It simulated the high pressure/temperature conditions inside the submarine reactor in order to test the fuel rods. It was calculated by Dennis Dawson, head of reactor design at Harwell, that there was enough energy within this experiment to cause serious damage to the core should the loop ever fail. Even so, no backup shutdown system was fitted to the reactor to ensure the safety of the reactor should an accident ever happen with the experiment.

A larger test loop, the PAT (PLUTO AGR Test) Loop, was to test AGR reactor fuel rods, was completed because of worries about safety by the Nuclear Installations Inspectorate. Because it used equipment from outside the AEA, the NII became involved in the safety for this experiment - the loop never operated because Harwell could never prove a safety case to the NII, mainly because of the condition of, and lack of safety systems in, the PLUTO reactor.

After much pressure from myself and colleagues, and following on from the report to the Commons Energy Select Committee on reactor safety at Harwell, the two materials testing reactors at UKAEA Harwell closed on March 31st, 1990. According to the Harwell management the reason for the closure of these reactors is purely a matter of economics, not safety. This is not accurate representation of the truth.

In January, 1990, "ATOM" (the AEAs magazine) had an article on the safety of the Harwell reactors, stressing that after a safety audit by the NII, the reactors were safe and could operate for many years to come - this is not in fact the case.

The NII safety audit was conducted after the Department of Energy finally succumbed to pressure from ex-employees, not least the ex-head of reactor design and research at Harwell. Its terms of reference covered not only the reactors, but also the experiments which operated within them. This audit was carried out from Dec. '87 to January '88. The results of this survey, despite the fact that it was initiated by public pressure, have never been published. The only information we have about the safety audit is a Health and Safety Executive press release.

The actual situation was as follows...

The reactors were built with a design life of 25 years - even so after 34 years the DIDO reactor was still running. Due to wear and corrosion, the drain lines from the reactor vessel suffered a number of pinhole leaks - in the event of the reactor pressurising, for example if an experiment ruptured, they almost certainly could have burst. For at least fifteen years the connections to the biological shield cooling coils leaked and saturated the concrete of the biological shield with water - this cause cracking of the shield in DIDO, and by the AEA's own admission an unknown amount of corrosion of the reactor vessel. The reactors are the only ones in the country to have the control room sited in the same room as the reactor - quite often operators had to evacuate the control room when airborne activity became too high.

These were not safe reactors by any sense of the word.

In February 1989, the AEA announced that PLUTO would close in March 1990, but DIDO would continue to operate for a number of years. On February 14th 1990, totally without warning, the AEA announced that both reactors would close on March 31st. This came shortly after the publication of my reports, originally prepared for the Commons Select Committee on Energy, on the state of the reactors and associated plant at Harwell. Again, this closure was due to 'economic and not safety considerations'.

The closure for economic and not safety is not a true. At the time, the reactors were earning in excess of £1.5 million a year from silicon irradiation for the semiconductor industry. Revenue from other contracts in the reactors, such as the MoD's DIDO loop, and work on isotopes for Amersham International, could be expected to have brought in more than £2 million a year. Also, you do not expect a research reactor to operate economically - the point of research is not to return a profit. Research essentially entails laying out capital for investigative work. If lack of work was a problem, why did they decide to completely close the reactors, rather than mothballing them until new business came along?

The NII, had they been required to license the reactors, would not have approve the safety case for the reactors in their condition. Also, the safety case for experiments such as the DIDO Water Loop were highly suspect given the fact that the NII would not approve the PAT loop. It was estimated by the Harwell Reactor Research Division in 1985 that £18 million would be needed to bring the reactors up to standard. Following our disclosure of information on safety, and because of the increasing pressure put upon the AEA to have safety taken out of internal management systems and given to the NII, their only course of action was to shut DIDO as well as PLUTO.

These reactors closed because the report for the Commons Select Committee on Energy exposed the defects in the reactors and the Harwell management structure running them. They had to close because they could not risk an accident after the report detailed the faults, They could not afford the money to put these defects right either. The final nail in the coffin was the proposal to give safety regulation to the NII.

The fact that the reactors have now closed is not the end of the problem. They still pose a radiological hazard, and will do so until they are safely decommissioned - and here we get to another problem!

References

1. Data from a internal safety report on the MTR reactors.

2. The fire in plutonium pile No. 2 at Windscale in 1957 was caused by the overheating of fuel channels. It was not possible to shut the reactor down due to the damage to the control rods. Following this incident, independent secondary shutdown systems were fitted to reactors, so that in the event of failure of the main control rods, the secondary system could be engaged. Such a system was never fully installed in the Harwell reactors, and the system which was proposed was not credible, due to the design of the reactors.

3. Now working system was ever fitted to the reactor. A system was fitted to the PLUTO

reactor after the NII requested it as part of the safety case for the PAT Loop, but it was never commissioned.

4. Elsewhere in the nuclear industry, all nuclear plant had to be inspected by an independent regulator, the Nuclear Installations Inspectorate. At Harwell, safety was regulated by a committee of managers, and employed consultants. Though they were requested to keep the same standards as exercised elsewhere in the nuclear industry, this appears, from the evidence on the condition of the reactors, not to have been carried out.

5. As part of normal checks, and research, for submarine reactors, spent fuel rods are irradiated in test reactors to check how they would stand up to abnormal conditions, or to check how they behave under prolonged operation at different running conditions.

C. Decommissioning

It was announced in February 1989 the PLUTO reactor was to be shut down and decommissioned. It was stated in the press release that it would enable Harwell to develop further its expertise in decommissioning nuclear plant. However, Harwell have no practical experience in decommissioning reactors. The only practical experience of decommissioning within the UKAEA is held by the UKAEA's Northern Research Laboratories who are currently decommissioning the Windscale Prototype AGR - a totally different type and scale of reactor.

In terms of actual decommissioning, no large reactor has ever been fully decommissioned. The detailed research on decommissioning has only really begun in the last ten to fifteen years, because most of the first wave of nuclear reactors built between 1945 and 1960 will be shut before the end of this decade. At the moment only four reactors - the Windscale AGR prototype, Berkley Magnox, and DIDO and PLUTO - are being decommissioned. All the other reactors in the UK, including at least another three at Harwell, and HERALD at Aldermaston, are being kept in mothballs until the day that they can be safely taken apart.

All the current decommissioning work at Harwell is only to tidy the site around the reactors. All unnecessary buildings and auxiliary plant will be removed, until only the reactor, its containment building, and the services (such as air conditioning) vital to keep the reactor safe, remain standing. Other associated parts which are highly contaminated, such as the spent fuel storage pond and gloveboxes from the hot laboratory, will also have to be kept intact for a number of years.

A recent article in the AEAs' magazine, "ATOM", reported on the progress of decommissioning at Harwell. They had in fact tried to go further than that outlined above, taking apart the reactor itself - however, due to radiation levels they have had to seal up the reactor vessel again. They are now going to mothball them, for what appears to be an indefinite period.

The Dounreay MTR, which is almost identical to the PLUTO reactor, and has been shut down for many years. If the safe decommissioning of DIDO and PLUTO is proposed, it may be useful to decommission the Dounreay MTR reactor first. It has been shut-down for many years and thus some of the fission products within the core have decayed and the dose to workers will be significantly less. This would give a significantly reduced dose to the workers dismantling the reactor.

The knowledge gained from decommissioning the Dounreay MTR would then help with the decommissioning of the Harwell reactors. Under agreements made, the AEA are required to undertake decommissioning works in the most cost effective way, whilst ensuring that the workers receive the lowest possible dose of radioactivity. Under this agreement, they should be decommissioning the Dounreay MTR first!.

The only thing against decommissioning the Dounreay MTR first would be if recent reports that it suffered an accident in the late 1960's were true. When the reactor was shut down for good in 1969 no reasons were given. The rationale at the time was that the AEA only needed two research reactors, and so its closure was merely an indication that they were concentrating their work at Harwell.

Sources within (at Sellafield - confidential) the nuclear industry give a different story. In the late 1960's the Dounreay reactor had an accident, which the management kept under raps. At the time the Fast Reactor programme was just getting underway at Dounreay, and any accident on site would have been very damning.

During the incident in the reactor, possibly due to overheating, one of the fuel elements burst open, and spread its entire contents around the primary circuit - this is similar to an incident in the DIDO reactor which contaminated the primary circuit with Cobalt-60. This incident also caused other fuel rods to distort, and apparently, there may still be one or two fuel rods still inside the reactor which could not be retrieved. Luckily, there was no contamination outside of the reactor containment - but this also made things much easier to keep under raps. All AEA work at the time was done under the Official Secrets Act, and so none of the reactor staff would have been able to do, or say, anything about it.

All efforts on my part to establish the status of the Dounreay MTR have met with no response by the AEA or the Government.

The DIDO reactor has been in place for 38 years, PLUTO for 37, GLEEP for 47, BEPO for 46. They will have to remain intact for at least another 50 years. Can their integrity be guaranteed over this timespan without additional engineering works to properly seal them?.

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. The reactors are raised up on pillars, 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.

The actual method of decommissioning the Harwell reactors has not yet been fully outlined. Plans were made for disposing of both reactors. A scheme was put forward by the Design Dept. of the Reactor Research Division at Harwell which involved stripping down the reactor to the biological shield. At this point the reactor becomes quite a small object, which could be moved inside the main part of the Harwell site to be put into long term storage until it is safe to break up.

If the reactors are being left to allow fission products to decay, the core of the reactors should be completely sealed. In thermal reactors some 79 isotopes with half-lives of more than one year are produced. Of these only around ten are of radiological significance when considering decommissioning. To ensure operator doses are as low as possible, at least fifty years would need to pass to ensure that these products had decayed to a safe level.

Finally, there is the whole issue of what will be done with the core. It is conceivable that the core may be sealed and buried on site. Once encased in concrete, and the outer building removed, the encased core would possibly be around 40 feet in diameter (depending on the amount of concrete used to seal it). Do Harwell propose to eventually bury this on site, or to allow the fission products to decay and then break up what is left. A statement needs to be made now concerning the actual proposals for decommissioning the reactors.

The AEA should be asked to create detailed plans in association with the NII, the National Radiological Protection Board (NRPB), and the Department of Energy, and the local authorities, to ensure that the best possible programme for safe decommissioning. This plan should also be available for public comment.

If the site is to be returned over time to 'green-field' open space, an absurd concept but one which is often put forward by the nuclear industry when talking about decommissioning, 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 used toxic chemicals. By investing in the proper technology now, we will reduce the need for costly clean-ups later on.

It is important to always 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 these problems, these millstones around our necks, to the next generation?.

D. Groundwater Pollution

The groundwater aquifers below the Harwell site, which supplied water to the local people via boreholes, is contaminated with chlorinated solvents, and possibly other substances. That is fact. As yet, neither the National Rivers Authority or Thames Water have put their cards on the table and stated that they believe that the Harwell Laboratory is the source of the contamination. What other sources are there?.

If Harwell is the source of the pollution, as is widely suspected, it will be a great irony. From 1974 to 1978 Harwell was the centre of UK research into the effects of leachate from landfill sites on the environment. To this day, Harwell conducts work on the hazards of landfill dumping, and the majority of the work on landfill dump problems is published through the annual, 'Harwell Waste Management Symposium'.

Is it possible that all these experts were able to overlook the effects of landfill dumping of chemical wastes in their own back yard?. Were they aware of it - but chose to study the effects?. Much worse - were they aware of it, but chose to deliberately ignore the possible consequences on the local environment?.

It is highly likely, but as yet is to definitely be proven, that solvents dumped in landfills on the Harwell site have contaminated a large part of the local groundwater. In turn, this water is being tapped for drinking, and so local villages risk getting chlorinated solvents on tap.

The material which is causing the contamination has been in the ground for at least thirty years. It has thus taken up to three decades for the contamination to travel three miles. Even in the event that all the contaminated material was removed from the two waste sites, it could be many decades before the pollutants in the local groundwater aquifer disperse fully.

Harwell have a major problem on their hands, and despite the fact that they have designed and built clean-up plants for the contamination beneath the site, they will not admit that the contamination in the Blewbury water supply is due to their pollution. Hopefully, the final results from surveys by the National Rivers Authority (NRA) should prove this causal link sometime - but at the moment they too seem to be unwilling to 'take on' the AEA.

During the early 1980's the British Geological Survey conducted extensive surveys of the Harwell area to determine whether or not the local strata were suitable to house a low-level waste disposal site. Their conclusion was that the local geology was very complex, very unpredictable, very porous, and very unsuitable for housing a waste repository. This, to any intelligent scientist, should have set alarm bells ringing as Harwell already had two sites containing toxic chemicals - but nothing was done. The boreholes, dug for the geological survey, were there ready for groundwater sampling. The laboratory facilities for testing samples existed on site - in house. Yet no samples were taken to check on the spread of contamination - or if they were, Harwell have not admitted they did so.

Following the British Geological Survey studies all was quiet on the groundwater front, then, on March 23rd, 1990, 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.

The geology of the area is greensand overlaying chalk. Diagenesis has caused increased porosity of the Upper Greensand, Upper Gault and parts of the Lower Chalk, and 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 taped for drinking water.

E. Waste disposal

"Much criticism has been made of the methods used at British Nuclear Fuels Ltd's Drigg site in Cumbria. From what can be deduced, the methods used at Harwell are not dissimilar. The practice of depositing waste in an area with a geology of underlying chalk, very close to one of the countries major watercourses needs to be looked into to ensure that there is no danger of leakage of radionucleides off site".

That paragraph was contained in the report written for the Commons Select Committee on Energy in late 1989, long before the pollution of local drinking water came to light. I do not have a degree in Hydrology, but if I could understand that the local aquifer could be easily polluted, I am sure that the highly qualified staff at Harwell could. That would make them negligent, because they did not investigate the possibility that their waste could be making its way into the local water supply. They only began investigations when Thames Water discovered the contamination.

Due to the lack of regulation over the years, waste management and disposal practices at Harwell have relied on patching together schemes which, it was hoped, would get rid of their wastes without causing contamination. As has been shown recently, this has failed.

Harwell buried quantities of low-level waste on site (the "Meashill Trenches"). Later, and to the present day, they incinerated low-level wastes in a special incinerator, and sent the radioactive ash to Drigg in Cumbria. Excepting the low-level waste packaging area, the highest background radiation readings (my own study found about 0.2uSv/hour) are found around this incinerator.

The nuclear waste incinerator at Harwell has been operating for a number of years, and yet it was only in 1990 that the Department of the Environment went through the process of authorising discharges of radioactivity into the atmosphere. Many local people are opposed to this incinerator being operated at Harwell. Also, is it wise to carry out such operations in an area of high population density?.

The discharge of low-level radioactive effluent into the Thames needs reviewing as well. On its own it may not be a hazard, but only a short distance down stream AWE Aldermaston has its discharge, and AWE Burghfield also discharges effluent into the Thames via the River Kennet. What are the cumulative effects of these three discharge points?. It has been noted in Harwell's own monitoring reports that an 'enhanced' level of beta activity exist in the silt near the outfall into the Thames, and that these levels follow a pattern with the levels of caesium and plutonium isotopes within the silt.

In 1961 the pipeline carrying effluent to the Thames sprung a leak and contaminated 100 cubic metres of soil. Yet it wasn't until 1990 that consideration was given to the radiological hazard this might present to the public. Harwell were always very dismissive of the significance of this contamination, and it wasn't until I gave the information to the local media that they actually rushed to remove the contaminated soil. Even then it was only dug up and then dumped on the Harwell site. If this episode represents their concern about environmental pollution, can they be trusted to ensure the safety of their future discharges into the Thames?.

There was also a leak from the pipeline in 1988 which contaminated the surrounding soil at the Grove Farm commercial apple orchard near Harwell. This leak is still being monitored. The only improvement which has been made to the pipeline is to renew the regularly spaced access holes - there has been no thorough check on the actual pipework to ensure there is no seepage occurring.

Due to the design of the pipeline, some effluent must always be kept in parts of it at all times to prevent air locks developing (inside information - confidential source). There are also three pumping stations along the way; just North of Harwell (by the main road), on the Milton Common Estate near Didcot (next to the roundabout), and the last is in Sutton Courtenay village (down the lane past 'The Fish' pub). From what can be found out, no exact measurement of how much waste goes in and comes out of the pipe is taken - only a rough estimate is known. Any leak must be on a large scale if it is to be detected. Small leaks or seepage from pipe joints would not be noticed for some time.

It is widely known that drums containing intermediate level radioactive waste are stored at Harwell. Many of these barrels have been in store since 1982/3, and as stated by Harwell in a letter some time ago, the design and construction of these drums gave no thought to their retention capability during prolonged above ground storage.

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 (IAEA) has criticised NIREX's repository design and proposed construction methods, and NIREX itself has just announced a radical redrafting of their generic design<6/13> to get around the problem of using special elevators for access. 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?. A conservative estimate would be at least another fifteen to twenty years - assuming there are no more problems with the repository design and construction.

If these drums 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, though neither Harwell or the Department of Energy will reveal how many. Surely, in terms of the risk of radiation doses 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?

It is true that the slow leakage of material from these drums 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 problems which could develop in the coming years.

Non-active wastes consist of many types of material - from old rope to toxic chemicals. From the late 1940's up until 1977, a large proportion of the more 'difficult' wastes, such as toxic chemicals, were dumped in two areas of the Harwell site. This material is currently making its way into the local water supply. From 1977 onwards, most of the wastes were either packaged and moved to approved disposal sites for toxic and industrial waste, or if they were suitable, processed, diluted, and flushed into the Thames through the pipeline.

I have yet to find any individual to stand up and publicly confirm it, but I believe that some toxic material are still being stored in unsuitable conditions, above ground, where any contamination which is washed off the barrel, or leaks out, can enter the surrounding soil. This would be in contravention of the waste disposal license issued to Harwell in 1984 by Oxfordshire County Council. On the western edge of the site, where there is construction work going on, there are many drums of chemicals, oil, and waste material, stacked around. The stacks are not on properly constructed hard standings or drained areas. Most are just stood where any contaminated run-off will flow onto the surrounding soil, and then down into the ground.

There needs to be a thorough review of the waste disposal practices, past and present, by the local waste regulation authority - the County Council. Unless Harwell are open about how they handle their wastes, it will be impossible to ensure that other incidents, like the pollution of the local groundwater, do not happen again.

F. MoD Involvement

The government body, which in 1954 became the Atomic Energy Authority, was not originally tied into the Ministry of Defence, but as time went on it became dominated by the MoD. Later, the Aldermaston and Burghfield sections, which comprised the AEA's Weapons Division, would be completely transferred to MoD control. The prime motive behind the construction of the Harwell Laboratory and its associated reactors and other nuclear research facilities was to support the development of a solely British nuclear programme which would in turn provide the expertise - and fissile materials - to produce atomic weapons.

Various parts of the Harwell site, since it became part of the AEA in 1954, have been utilised by the MoD in support of nuclear weapons projects - most notably building 220 and its remote handling/plutonium machining facilities. The DIDO reactor and its associated post-irradiation facilities were also involved with the necessary ongoing research to keep the Polaris submarine atomic power plants ticking over.

The division of where military and civil safety standards apply at Harwell has never been made clear. It is hard to say if all facilities are covered by civil regulations, or whether certain sections are run with military standards either part of or all the time.

The use of the Harwell facilities by the MoD must be scrutinised. As a public organisation the UKAEA are subject to IAEA/EURATOM rules. However, in much of the research on safety done by myself and other individuals, the UKAEA have found 'national security' a very useful cloak to hide information of certain aspects of safety of the reactors and other plant. An investigation needs to be done to ensure that the UKAEA are living up to their IAEA/EURATOM commitments.

The MoD used to have their own materials testing reactors at AWE Aldermaston, not very far away from Harwell. In 1986, the last of their reactors, HERALD, was closed down and the work was contracted out to Harwell.

The most major experiments conducted by the UKAEA for the MoD involve the testing of nuclear submarine power plants and fuel rods. This is the purpose of the DIDO water loop. It simulated the conditions inside a submarine power reactor. Speculation has also been made about the role of Harwell in atomic weapons research. By the late 1970's the MoD had completely took over building 220 at Harwell, which houses hot cells and handling equipment for plutonium, for their own use.

It was revealed by the director of the UKAEA's Nuclear Materials Control Office, Dr. Brian Hooten, that Harwell handles nuclear materials outside of the safeguards of the IAEA/European Safeguards Research and Development Association. However he added that nuclear materials are only 'very seldom taken out of safeguards' at Harwell because 'the Department of Energy don't like it'.

The prime reason for having safeguards on fissile materials is to ensure that no fissile material ever missing, and thus it should never fall into the hands of any terrorist group, non-nuclear state with aspirations of greatness, etc. Another point of safeguards is that it strictly identifies civil and military fissile materials. It could be a very serious matter if, while out of IAEA safeguards, Harwell's civil material was swapped for lower grade military material.

The question must arise as to why it is necessary to take nuclear materials out of international safeguards, and what regulations it is kept under while these safeguards are suspended?. Should they be allowed to take such action in the first place without the permission of the government? If the Government, who are in charge of enforcing nuclear materials safeguards in the UK, cannot keep control of the AEA, what trust can the international community have in our competence as a responsible nuclear power?.

Secondly there is the question of the use of plutonium by the MoD at Harwell. From the work I have carried out Harwell does not have a plutonium smelting facility. Therefore the plutonium must be transported to Harwell in its natural metal state, rather than as an oxide. This obviously presents problems of safety and security. Also, are the precautions taken for the shipment of such cargos done under MoD or IAEA regulations?. It is hard to tell, as presumably the materials are transported by the MoD's Special Materials Transport Group.

Areas of responsibility should be made between the UKAEA and the MoD. The two authorities would then be responsible for their actions in those parts of the site. This should stop the current confusion with the UKAEA hiding behind the MoD over certain areas of the site's work. It would also mean that strict standards could be set within the site, rather than the UKAEA switching between IAEA/EURATOM and MoD standards as they do at the moment. An inquiry should also be held into the suspension of international standards governing nuclear materials at Harwell, and such instances should be forbidden from occurring in future.

As stated, building 220 has for many years been used by the MoD. Plutonium has a very limited application - you either burn it in fast reactors, or you make bombs out of it. Harwell does not play a major role in the UK Fast Reactor programme, which leaves only one other alternative use for the hot laboratory and plutonium machining facility at Harwell - weapons manufacture. The MoD and the AEA maintain that Harwell is only involved in weapons research, but that cannot be verified independently. Also, a plutonium component for a 'research' warhead, could easily be transferred to a live, ready for use, warhead.

It was announced a few years ago that there would be a £40 million refurbishment of building 220, mainly dealing with extra air supplies and filtering, and new power supplies for the building. When the site was licensed in 1990, building 220 was presumably not passed as safe for the type of work it was carrying out, hence the need for the extra work on the safety features of the building. This work was announced shortly after the A90 complex at Aldermaston, which was to make the new warheads for Britain's Trident missiles, was scrapped, partly demolished, and construction work restarted again. Are the two events linked?. The A1 complex at Aldermaston, which made the Polaris warheads, does not have the capacity to make all 512 Trident warheads by the time they will be required for service. Will Harwell conduct some of this work to make up the shortfall?. It is a strong possibility, as building 220 is the only other site in Southern England, and the nearest site to the bomb making plants at Aldermaston and Burghfield, which is capable of this work.

The role of Harwell in the manufacture of nuclear weapons needs to be made clear. With the end of the cold war, and the dispersal of the perceived 'threat' from nuclear weapons, it is not necessary to so closely guard so many of the facts surrounding our past and present use of facilities for the manufacture of nuclear weapons. If plutonium is in regular use at building 220 it should be openly stated, in order for the necessary steps to be taken to ensure that the site is secure from any attempt at theft, and that the local authorities are able to make suitable emergency plans in case anything goes wrong.

G. Employee Safety

The Gardner report on the incidence of leukaemia around Sellafield has a significant bearing on the health of those who worked in the reactor area at Harwell. Some workers in the reactor area at Harwell 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.

The UKAEA, and Harwell in particular, have a poor record of protecting their employees form radiation. Before the recent revision of standards, if a dose exceeded 15mSv 9yearly or instantaneous) an investigation must be carried out to determine why it happened, and measures taken to prevent it happening again. The UKAEA has said of the 15mS investigational dose in their safety report on the DIDO and PLUTO reactors, "this requirement effectively places an individual dose level at which an investigation should be made into whether the 'As Low As Reasonably Practicable (ALARP) principle is being effectively applied - it is not a dose limit and there is no implication of a requirement to keep individual whole body dose below 15mSv in a year, nor is there any implication that ALARP is being effectively applied if doses are kept below that level. Requiring employers to carry out what is reasonably practicable to achieve safety is a long established principle of British safety regulations".

It is true that the 15mSv investigational dose is not a dose limit, but neither is this a license to allow the individual dose to employees to rise to near the whole body dose limit. If employees regularly exceed the 15mSv whole body dose it can be questioned whether the employer is applying the ALARP principle effectively, purely and simply because it keeps re-occurring. Below are the numbers of employees in the Harwell reactor area who exceeded the 15mSv dose between 1982 and 1986 (only figures available):

Year	1982	1983	1984	1985	1986
No. exceeding 15mSV dose	99	98	61	54	35
No. exceeding 50mSv dose	0	0	0	1	0

It can be questioned whether or not the Harwell management were applying the ALARP principle within the reactor area. The number of employees exceeding the investigational dose give cause for concern. Are regular checks being kept on these workers now to ensure that their health has not been affected?.

The sudden drop in the numbers getting more than 15mSv after 1983 is due mainly to the closure of the BEPO reactor. Even, comparing the percentage of AEA radiation workers who exceed 15mSv to the percentage of BNFL/CEGB radiation workers who exceed 15mSv (and adjusting for the different sizes of the workforce), the AEA have about 2 times as many workers exceeding the 15mSv threshold.

All radiation dose limits are based upon studies of the survivors of the Hiroshima and Nagasaki atom bombs, and of other groups, such as the Marshall Islanders affected by radioactive fallout from atom bomb tests in the Pacific. The drawback with these studies is that it takes account only of sudden, short-exposures, to very high levels of radiation. There has been very little study of the consequences of long-term exposure to low-levels of radiation.

The National Radiological Protection Board produced a study a few years ago (reproduced in the British Medical Journal) of the effects of low-level radiation using the health records of radiation workers in the UK nuclear industry. This study is significant, not only because it shows that the new dose limits, due to be in force by 1995, are too high, but also because it shows how radiation levels within the AEA compare to other parts of the nuclear industry.

The figures produced by the NRPB show that, over its operating lifetime, 730 workers were exposed to a level in excess of 100mSv. This figure is only bettered within the MoD (789 civilian staff) and at Sellafield (4093 staff). It is the highest within the AEA, Dounreay following closely behind on 710 staff.

For comparison, the table of data from this report is reproduced below:

	No. workers receiving			Site Mean/	
Site.	>10mSv	>50mSv	>100mSv		Worker.
Chapelcross	567	351	451		76.7
Sellafield.	4730	2222	4093		92.7
MoD Weapons Research Establishments	1249	239	154		8.3
Navy.	1623	133	37		6.6
Army.	315	42	49		8.6
RAF.	491	6	1		3.7
MoD civilians*.	2206	837	789		26.7
Harwell.	2701	716	730		23.1#
Dounreay.	1853	584	710		40.7
Winfrith.	755	311	464		45.9
Berkley Power Station. 221	111	182		68.7	
Bradwell P/S.	245	128	85		43.3
Hinkley Point P/S/	749	214	85		31.4
Trawsfynydd P/S.	260	112	120		51.8

*The figure for MoD civilian workers represents the numbers of civilian workers employed by the MoD, mainly to carry out building/repair work in MoD establishments. One such example would be civilian staff working on nuclear submarines in dock.

The above table is not very representative of the comparisons between the site. It would be more useful to express the percentage of people on the site receiving in excess of 10mSv. From these figures it would be possible to judge the level of radiological protection workers on each site received.

For example, the collective mean dose for the Harwell site (marked #) is much lower than all the others because it is diluted by the large numbers of staff working on the site.

The table below, calculated from the figures listed in the NRPB report, shows the numbers at each site receiving more than 10mSv. The numbers receiving greater than 10mSv, 50mSv and 100mSv are then expressed as a percentage of this figure.

Site.	>10mSv	%>10	%>50	%>100
RAF.	498	98.59	1.20	0.20
Navy.	1820	89.18	7.31	2.03
Hinkley Point P/S/	1048	71.47	20.42	8.11
MoD Weapons Research Establishments	1642	76.07	14.56	9.38
Army.	406	77.59	10.34	12.06
Harwell.	4147	65.13	17.27	17.60
Bradwell P/S.	458	53.49	27.95	18.56
MoD civilians*.	3832	57.57	21.84	20.59
Dounreay.	3147	58.88	18.56	22.56
Trawsfynydd P/S.	492	52.85	22.76	24.39
Winfrith.	1530	49.35	20.33	30.33
Chapelcross	1369	41.42	25.64	32.94
Berkley Power Station. 514	43.00	21.60	35.41	
Sellafield.	11045	42.82	20.12	37.06

Employer.	>10	%>10	%>50	%>100
MoD Research Est.	1642	76.07	14.56	9.38
Nuclear Electric.	3709	68.29	18.74	12.94
MoD Civil staff.	3832	57.57	21.84	20.59
UKAEA.	8998	60.62	18.13	21.25
BNFL.	15934	48.49	20.03	31.49

As can be seen by this table, the UKAEA would appear to be the worst employer, except for BNFL. When you consider the type of work being carried out, it would also tend to demonstrate that the AEA have put less work into radiological protection.

For example, workers at BNFL deal with the most radioactive substances in the UK, and yet the AEA, conducting research, come closely behind them in the league table. To put it another way, workers at nuclear power stations handle fuel rods, and work in close proximity to large reactors. However, the AEA still managed to dose up an equivalent of 70% more of their staff above 100mSv.

For a direct comparison, look at the MoD research establishments. Workers here were carrying out research work with radioactive substances, but an equivalent twice as many AEA workers received in excess of 100mSv.

Perhaps the most alarming is AEA Winfrith. They have the smallest number of workers exceeding 10mSv, and yet they have the highest equivalent dose when compared to other AEA sites. This would indicate a poor regime of radiological protection. This can be partly blamed on the Steam Generating Heavy Water Reactor operating at Winfrith. It did not have a heat exchanger 9the turbines were within the primary circuit) and so over time the turbine blades became very active.

H. Intermediate waste stores.

Most nuclear establishments in the UK possess a certain amount of intermediate waste on site - suitably packaged. The largest collection is at Sellafield, mostly arising as the by-product of fuel reprocessing.

After Sellafield, Harwell has the largest stocks in the UK. The other major store is at Dounreay, again, due to the reprocessing of spent fuel on the site.

There has never been any confirmation exactly how much intermediate waste is stored at Harwell, but there have been unofficial estimates putting the stock in excess of 3500 waste packages.

Harwell used to produce waste from the everyday operation of its reactors. Now that they have closed, and are being decommissioned, this generates more bulky items (e.g., pipework, contaminated equipment). There are also other sources, such as the decommissioning of a particle accelerator on site, and of the old hot laboratories.

Much of the current waste stored on site was not produced at Harwell. Most of it is barrels of waste originally intended for disposal at sea. When the National Union of Seamen refused to handle the waste in 1983, there were hundreds of drums stranded at ports, and on trains. Most of it was brought to Harwell.

The sea-dump drums are risky for two reasons.

Firstly, they were designed to leak. After reaching a certain depth a baffle plate inside the container was designed to burst and let sea-water flood in. After a while the inner steel container corrodes away, and lets the contents leak into the ocean by diffusion, through three vents in the end of the barrel. Other drums have a slightly different design. Water entered through gaps around the side of the barrel and saturates the concrete. The inner container then corrodes away. Over a longer period the effect is the same - the waste leaks out by diffusion.

Secondly, as admitted by Harwell, the design of the package was not intended for long term above ground storage. The drums have now been stored at Harwell for nearly nine years.

If everything goes to NIREX's plan, the UK waste repository will be open for business in 2005. If the drums are to hold their contents securely until that date, repackaging would be essential. As stated, some repackaging has been carried out, but on what scale, no one will admit. On the basis of dose to workers, it would be safe to repackage the contents before, rather than after, they begin to leak their load.

I. The Thames Pipeline.

The pipeline to the River Thames has been operational since the 1950's. During this time it has had one major leak, in 1961, and an unspecified number of minor leaks. It routinely discharges waste every working day of the year, a large proportion of this waste being water, with smaller amounts of liquid radioactive effluent and chemical wastes mixed in.

Originally, the course of the pipeline was kept secret. The course of the pipeline from Aldermaston to the Thames has common knowledge since the 1970's, but Harwell insisted on keeping theirs secret. This had the obvious result - in 1989 the local council dug it up whilst conducting roadworks in Sutton Courtenay. Following that, Harwell gave a map of the route to the local council.

The integrity of this pipeline needs a thorough review. Parts of the pipeline contain effluent all the time, in order to prevent air locks. Where liquid is present, there is the possibility of internal corrosion. On the outside, especially where the pipeline runs through different soil types (e.g., from Gault onto the alluvial clays) there is the possibility of electrochemical corrosion due to the differing acidity of the earth surrounding the pipe.

It has been stated that the amounts of waste entering and leaving the pipeline are monitored, and that regular checks are made along the route for the presence of radioactivity. There are two main flaws to this argument.

Firstly, if waste is kept within the pipeline, you will not always get a constant input and output - there will always be a certain percentage of error. It is impossible to tell whether such an error is because slightly more or less waste stops in the pipe, or whether it is slowly leaking waste into the environment.

Secondly, The low level of the discharges means that and radiological survey conducted along the route would not find small leakages. Three or four feet of soil is more than sufficient to shield a small leak for a number of days - and that is assuming that such surveys are carried out on a regular basis.

I have travelled some sections of the pipeline route, and at two spots I found there to be a slight peak in the general background radiation readings. Whether this represents past or current leakages, I could not determine.

Unknown quantities of waste could be leaking from the pipeline today, tomorrow, and perhaps next month too. Given the nature of the material carried, it would be justifiable to ask the AEA to excavate and check each pipe section and joint. Most of the sections and joints are forty years old, and in the variable sand, clay, chalk and Gault which it runs through, there could be areas of extensive corrosion.

J. Sutton Courtenay

Down the lane that runs past 'The Fish' pub in Sutton Courtenay is the final pumping station on the pipeline route. It is a large area of buildings, extending to the South. Behind this part of the village are three disused gravel pits. Two are used for fishing, and one, directly behind the pumping station, has a nominally secure fence around it. I say nominally, in that it does not seem to stop the determined local youths from gaining access.

When the HMIP issued information on Harwell's discharges, and which discharges were to be renewed, there is no mention of any discharges at this gravel pit, there has never been any mention in Harwell's own data of any discharges in the gravel pit, and so it would be safe to assume that no discharge is authorised into the gravel pit. If this is the case, the discharge which does exist, and carries effluent from the pumping station into the gravel pit must be illegal.

From the colour and consistency of the effluent, and the fact that it is released in short batches, it is probably the overflow and/or sludge from a settlement tank of some sort.

The discharge is not the only point of concern at the gravel pit. On the Southern and Eastern fringes of the pit, Harwell have deposited large volumes of 'rubbish'. I presume that it is Harwell who deposited this material here, because it mainly consists of laboratory flasks, chemical containers, and old low and intermediate level radioactive waste drums - not domestic refuse.

The radioactive waste drums are not a major hazard, and radiation readings I have taken indicate that only a very minor level of residual contamination exists. However, from their condition, they must have been dumped here more then twenty years ago. Assuming that the contamination is due to isotopes of caesium, strontium and other short lived radionucleides, the activity levels when first dumped could have been significantly higher - anything from a factor of two to four times higher.

The laboratory equipment consists mainly of plastic flasks, screw top jars and tubing. There is also a lot of rubble, air ducts, steel tanks, and other structural debris deposited around the site.

The highest readings came from a steel drum containing rubber tubing and old rope - this gave 24dpm, or 0.24uSv/hour. Though not radiologically significant, the major concern is that the AEA have obviously used this site as a secret store for contaminated objects, apparently without the knowledge of the HMIP, or the local waste regulation authority.

It is not the radiation levels which are the major factor here. Natural background levels in the area range from 12 to 15dpm. Levels around this site are in the region of 17 to 24dpm. What is at issue here is the possible illegal dumping of materials contaminated with radionucleides, and the discharge of slightly contaminated effluent without a legal consent. The three gravel pits share the local water table, and are only separated by twenty to thirty metres of coarse alluvial gravel and sand. An contamination of the middle pit would almost certainly flow down into the lower pit, which is used for fishing, and then off to the Thames.

Unknown hazards could lie beneath the surface of the site. It is doubtful that the AEA kept exact records of what was deposited in this area, and so the possible extent and nature of any contamination would be impossible to tell. The County Council, as the waste disposal/regulation authority, should take samples as soon as possible to determine exactly what has been thrown into the pit over the years. There should be an immediate investigation into the practices carried out at Sutton Courtenay over the years, and should it be deemed necessary, steps should be taken against the AEA to clean up the site, and re-route the discharge into the pit.

4. Conclusion

In this paper I have set out the effects of leaving Harwell to regulate itself. For forty years safety was regulated internally, and over time this led to a disregard for the common-sense practices carried out elsewhere. It appears that they are still acting in the same way today, despite the fact that they are now regulated in the same way as any other part of the nuclear industry. The recent incidents concerning the tyre burning plant (starting up without authorisation) and reactor decommissioning (cutting part of the reactor vessel away without the authorisation of the NII thus causing workers to be needlessly exposed to radiation) confirm this.

If we take the argument presented at the beginning of this paper - that the standards at Aldermaston are likely to have been similar to those at Harwell, then on the basis of what we know to have happened at Harwell the Aldermaston site could...

* have improperly maintained reactors on site, with no clear view of how to decommission them;

* have operating/closed waste disposal pits which present a risk to groundwater;

* have a discharge pipeline which may be leaking undeterminable amounts of effluent;

* have buildings and plant which give rise to undue radiation hazards to the workforce.

I believe that the following action should be taken in order to remedy the current dysfunctional state of affairs:

1). There needs to be an immediate review of management structures and operating procedures, and how this relates to the maintenance of safety standards on the site. As well as the official management practices, the informal systems, which allow certain practices to take place, or parts of the safety regime to be circumvented, need to be investigated. This investigation should be conducted by the Health and Safety Commission, and all its finding should be available for public scrutiny.

2). Concurrent with the above, there should be an investigation of waste management and waste disposal practices on site. The running of all parts of the plant should be included in this. In addition, the past management of toxic as well as radioactive waste on site should be fully investigated - this should include monitoring of pollutants in the groundwater beneath the site.

Such an investigation should be carried out by HM Pollution Inspectorate and the National Rivers Authority, and the findings should be made available to the public.

3). Concurrent with the above, there needs to be a thorough evaluation of existing radiological safety procedures. In addition, all decommissioning programmes, and the continued maintenance of all utilised and redundant active plant needs to be reviewed, and a programme drawn up for the future management of all decommissioning work and radioactive waste handling. Such an investigation should be carried out by the Nuclear Installations Inspectorate, and its finding should be made available to the public.

4). Following on from points 1 to 3 above, there should be a full public inquiry, held by the Government, into whether the Aldermaston and Burghfield sites should be run under their present structure.

Until 1991, when Harwell finally came under the responsibility of the Nuclear Installations Inspectorate, Harwell was obliged to maintain safety and operational standards practised elsewhere in the nuclear industry; the experience at Harwell shows that the obligation to keep these standards does not work, and that serious environmental damage can be the result.

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