WASC 1860

Proposal for WA
Transfer to ARO
Dr. G. Rotter
1944

WASC 1860

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Proposal by Dr G Rotter for the transfer of Waltham Abbey to the ARD with accompanying memo from Sir Robert Robinson, consultant to ARD

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[1498/6]

C.S./H.A.9409/44(1)

S.S.O.

Proposal for the Transfer of Waltham Abbey to the A.R.D.

1. Although the Armament Research Department is charged with the responsibility of discovering and developing new explosives, it has not as yet been provided with the necessary facilities to carry out experimental manufacture of promising explosives to a sufficiently advanced stage. A preparatory study of the processes of manufacture is particularly important in times of peace so that difficulties and delays may be avoided when large scale production begins in times of war. Not only would important data thus be obtained in the processes of manufacture but there would be available a reserve of technical staff, which would be invaluable in the construction of production factories.

2. At a meeting of the Scientific Advisory Council in October, 1942 there was general agreement that the provision of experimental plant for the production of explosives in the A.R.D. was an urgent necessity. A formal recommendation was endorsed that:-

> "The Research Department be supplied with an Establishment for experimental work on the production of explosives generally, but in the first place for RDX, and that C.S.A.R. be asked to provide this".

3. In subsequent discussions at the Ministry of Supply between S.S.O., D.G.I. and C.S.A.R., it was decided (i) that facilities be devoted to experimental work in production factories and (ii) that there was little prospect at that time of the creation of a large experimental full-scale establishment.

4. While it has not been possible to implement the S.A.C. recommendation in war-time, it has been consistently felt by C.S.A.R. and his Explosives Superintendents that it is in the national interest that the A.R.D. should have under its own control a Technical Development Section of a sufficient size to carry out pilot plant work and capable in an emergency of working on a large scale.

5. Sir Robert Robinson, F.R.S., Consultant to the A.R.D., has submitted to C.S.A.R. a memorandum in which he refers to the value of the Establishment at Sutton Oak in the development of manufacturing processes of materials for chemical war fare. He remarks that it has always seemed to him a striking anomaly that there should not have been similar equipment and facilities in the A.R.D. for Explosives. (Copy attached, Appendix II, Memorandum).

6. The Armament Research Department will soon be faced with the problem of re-assembling the Outstations now housed in Universities and elsewhere. This cannot be satisfactorily solved without an examination of the future scope, organisation and location of the Department. It raises again as an immediate issue the question of future policy regarding the provision of manufacturing facilities.

7. A memorandum on the future organisation of explosives research in the A.R.D. is herewith submitted. This is intended as a first contribution to the organisation of the whole of the Department, including its work on the applications of explosives to the development of armament. It envisages the formation of a unified group within the A.R.D. to deal with the fundamental study of explosives up to the stage of experimental manufacture.

8. The Department's buildings at Woolwich have suffered considerable damage as a result of enemy action during the war, much of which has not been made good. When depleted of the accommodation provided by its Outstations, the Department will be poorly and inadequately equipped to face the re-assembly of its Sections unless alternative accommodation is provided.

9. Building and other difficulties may prevent the erection of the necessary new buildings at the end of the German war. As an immediate (and temporary) measure it is, therefore, proposed to use existing accommodation at Waltham Abbey. In recommending the use of this site, the security aspect has not been considered. The proposal is made in order to cover the immediate post-war period and not as a permanent solution of the needs of the Department.

10. It is, therefore, recommended that consideration be given to the transfe of Waltham Abbey to the A.R.D.:-

(i) for the provision of facilities for the experimental manufacture of explosives.

(ii) for the re-assembly of certain Outstations of the A.R.D.

If agreement in principle could be given to this proposal, a more detailed scheme could be prepared.

(Sgd). J.E. Lennard-Jones.

Enclosure - 1.

C.S.A.R.

3rd November, 1944.
Fort Halstead.

TABLE OF CONTENTS.

Proposal for a site for fundamental and manufacturing research on explosives.

Submitted by C.S.A.R.

1. SUMMARY.

(1) In view of the necessity to find alternative accommodation for certain Outstations of the A.R.D. at the end of the German war, the future organisation and location of the Armament Research Department has been considered in some detail.

This memorandum deals with the organisation of fundamental research work on explosives up the the stage of experimental manufacture.

(2) The functions of such a group should be:-

(i) to provide a steady flow of new explosives with properties suitable to the functioning of different munitions.
(ii) to develop safe and economical processes of manufacture.
(iii) to ensure safety of Service explosives during processing, filling, and in use, and under storage and severe climatic conditions.

(3) Highly specialised scientists with suitable laboratories, factory buildings and equipment, are required for such work. The researches are closely related and should preferably be housed on one site.

(4) The ideal plan would be to equip a completely new site with modern buildings and plant. If this, however, should not be possible, it will be necessary to consider the adaptation of certain existing sites now used by Ordnance Factories.

(5) Of those examined, Waltham Abbey seems the most promising. It has a variety of equipment for the manufacture of propellants and explosives which renders it particularly suitable for experimental work on manufacture.

It also has buildings which might be converted into laboratories for the use of certain A.R.D. Outstations. . . . .

The site seems eminently suitable for the formation in the immediate post-war period of a unified group to deal with the fundamental study of explosives and their manufacture.

(6) It is, therefore, recommended that consideration be given to the possibility of transferring Waltham to the A.R.D. for these purposes.

2. FUTURE ORGANISATION FOR OUTSTATIONS OF ARD AND THE FUTURE ORGANISATION OF THE DEPARTMENT.

The Armament Research Department is faced with the problem of finding accommodation at the end of the German war for the staff now housed at Outstations in the Universities and Technical Colleges. There is at the moment, no accommodation at Woolwich or at Fort Halstead which would permit of a return of this staff without fresh building. This involves an examination of the future needs of the whole Department, its organisation and probable location. A detailed examination is, therefore, being made of the needs of the Department and, as a commencement, the views of the Superintendents of Explosives Research and of the principal Heads of Sections have been sought.

While most members of the Department would prefer the reassembly of the Department on one site, in order to secure the maximum collaboration between the many closely related sections of the Department, it is generally recognised that this may not be practicable in the immediate post-war period. An attempt has, therefore, been made to construct an organisation based on the geographical division of the Department into three broad groups as follows:-

(i) A group on fundamental research on explosives (including manufacture

(ii) and (iii) Two groups dealing with various fundamental applications of explosives in munitions.

This grouping is considered to offer the best means of dividing up the organisation into reasonably homogeneous units with clearly defined

functions. This memorandum deals only with group (i).

3. FUNDAMENTAL AND MANUFACTURING RESEARCH ON EXPLOSIVES.

For the invention of new munitions and the development of existing munitions, there is needed a steady flow of new explosives, and continuous attention to the improvement of the explosives now in use. It is necessary not only to explore the possibilities for new explosives, but also to discover the right conditions governing their safety in storage and in use. The next step is to investigate safe and economical manufacture of promising compounds. The work of a group employed on fundamental and manufacturing research should, therefore, be:-

(a) to provide explosives with properties suitable to peform their function as initiator, high explosives, propellants or pyrotechnics,

(b) to develop safe and economical processes of manufacture. A resume of the present position with regard to manufacture is given in the appendix,

(c) to ensure that Service explosives are safe during processing, filling, and in use, as well as under all conditions of climate and storage.

These three main lines of activity demand scientists of highly specialised types with different training and experience. These lines of activity will now be considered in more detail.

3. 1. Selection of Explosives for specialised functions.

(a) The field of investigation available for the discovery of explosives is very extensive, and sufficient staff should be provided so that adequate research is carried out and a constant flow of new substances made available for test.

(b) The fullest study of the properties of known explosives is essential since it enables the correct selection to be made for specific purposes, lightens the effort expended on the synthesis of new compounds, and points the way to the most promising synthetic work.

(c) Extensions to the uses of present day explosives are constantly needed; it is frequently found that existing compositions are not adaptable to new requirements; this entails adjustment to the composition based on a knowledge of the properties of the explosives.

(d) For many purposes, single substances give more reliable functioning than mixtures, and mixtures of explosives should be replaced by single substances or less complex mixtures wherever practicable. This also involves much research.

3.2. Manufacturing processes

Manufacture is clearly differentiated by techniques into two groups, viz. (a) manufacture of primary explosives and intermediates and (b) manufacture of propellants, and other derived explosives.

(a) Primary Products

(i) Explosives which show promise after systematic examination and functioning trials are investigated from the point of view of manufacture. These should be capable of manufacture on a scale appropriate to the demand and derived from materials likely to be in good supply, preferably in this country or, if not, in the colonies. Complete information on sources of materials should be readily available to workers on explosives.

(ii) Investigations on manufacture in the laboratory, on the pilot plant scale, and on full scale, are necessary. Hitherto, the facilities available in times of peace for large scale experimental manufacture have been inadequate, and this has led to considerable wastage of resources in times of war.

(iii) More attention should be paid both to manufacture of new explosives and on new processes of manufacture of present explosives.

(b) Derived explosives (High Explosives and Propellants).

(i) At the present time it is the exception rather than the rule for single substances to be used as such in munitions; for high explosive fillings they are mixed to give the required properties of power, insensitiveness, response to initiation, suitability for pouring, pressing, moulding, etc.; for propellants they require to be converted into a form having the correct shape, size, burning properties, so as to function accurately and safely.

(ii) The inflexibility of British chemical manufacture is a distinct handicap to the development of new explosives; as an instance may be cited the requirement of new substances for plastic and liquid propellants. It is desirable that these handicaps due to the non-supply of various intermediates should be removed as far as is reasonably practicable. Research may be necessary on intermediates, the production of which is based on raw materials available in the National economy as well as on explosives derived from them.

(iii) There is need for continuous research in the manufacture of propellants in order to improve ballistic performance in guns and other weapons, to reduce flash and smoke, to improve storage under extreme climatic conditions and to meet other service needs.

(iv) The methods of manufacture of mixtures used as high explosives, demolition explosives, pyrotechnics and in fuzes, caps and detonators, requires further development to obtain easier and safer methods of filling, be better performance, etc.

3.3. Safety and Reliability of Explosives in storage and in use

Research on the stability of explosives and their compatibility with materials with which they come into contact in munitions is essential for the safety of filling processes. This work is best combined with similar work on completed service munitions. This involves research in the labbratory, and on the filled store, under conditions simulating the most extreme climatic conditions likely to be met in Service.

The reliability of stores depends on the selection of suitable explosives and of the materials in which they are housed. From this point of view, research is carried out on stabilisers, waterproofing and weatherproofing of stores.

This has always been an important feature of the work of the A.R.D.

3.4. Preliminary study of applications of explosives.

One of the functions of the fundamental group will be to develop chemical substances to the point where it seems probable that they will be suitable for practical application. It will be necessary, therefore, for a preliminary study of possible applications of particular explosives to be made within the group.

It will be for the other groups more fully equipped to pursue the study of performance up to the fullest scale in filled munitions. Between the groups dealing with fundamental research and those dealing with applications there must be satisfactory liaison and this can only be obtained if they are not separated too far geographically.

4. THE ORGANISATION OF THE FUNDAMENTAL RESEARCH AND MANUFACTURE OF EXPLOSIVES.

4.1 The Site

The researches outlined above are all closely inter-related and should be preferably housed on one site. The relationship to certain sections dealing with the application of explosives is also close, and a grouping on adjacent sites for all of the work on explosives would be advantageous, but not essential, so long as there is good horizontal linking between the fundamental and application groups.

4.2. The Staff

The scientific staff of the fundamental research group would consist of organic, physical and analytical chemists and chemical engineers, and it is generally advantageous, on account of the high degree of specialisation of the scientists, to group together those working on one particular subject into the same section. The duties of the above staff would be as follows:-

(a) Organic chemists:- the synthesis of new explosives and development of manufacture of promising materials; the preliminary study of application to Service requirements.

(b) Physical chemists:- the preliminary study of the theory of explosives, the kinetics of manufacture, investigation of fundamental physico-chemical properties of explosives. The present physico-chemical group in the A.R.D. needs considerable expansion to cope with the proposed scheme of work.

(c) Analytical chemists:- the examination of materials, and the investigation of stability, compatibility and storage problems.

(d) Chemical engineers:- the development of suitable processes for large scale manufacture of explosives.

The sub-divisions of the group would, therefore, be:-

(i) Organic chemistry.
(ii) Physical chemistry
(iii) Analytical chemistry
(iv) Manufacture of single explosives and intermediates.
(v) Manufacture of propellants
(vi) Information bureau and library.

There should be very close horizontal ties between the groups.

4.3. Information Services.

There is a need for a strong information bureau and a library. The information bureau would co-ordinate information on explosives and their raw materials, on their properties, on chemical industry and on manufacture

5. REQUIREMENTS OF THE IDEAL SITE

The following are regarded as essentials of the ideal site.

(a) A reasonably level and capacious area, sufficient to provide a modern layout of laboratories, factory buildings, administrative offices,

workshops and other services, magazines, trial grounds and ranges. An adequate area (of the order of 200 acres) is essential to this scheme in order to provide safe spacing of explosives buildings.

(b) Services - A mains supply of electricity, gas, water and drainage is required. It is also essential to have adequate facilities for the disposal of effluents.

(c) Good transport facilities by road, rail and preferably water.

(d) Accessibility - the site should be near a transport centre to facilitate visits to Service establishments, Ordnance Factories, centres of industry.

(e) It should be reasonably near London in order to maintain contacts with the Ministries, the scientific societies and the larger libraries. This would be an attraction to the numerous types of staff required, and would facilitate recruitment. It would permit easy access to University and technical training establishments for the junior staff.

6. POSSIBLE SITES.

Failing an ideal site, adaptation of existing facilities within the Department, and also possibly of outside facilities which might be taken over, must be considered.

Visits have been made to Ordnance Factories to assess their possible value as a site for the whole of the A.R.D. In particular, two sites near to London at Burghfield and Elstow have been examined as typical of the Ordnance Factories likely to be available at the close of the war.

(a) Burghfield R.O.F.

This site is situated four miles from Reading and is centrally situated with respect to a number of Service establishments, e.g. R.A.E. Farnborough, Porton Experimental Station, Millersford, Larkhill, Bramley, etc. It is, however, somewhat too far from London for easy access for staff attending meetings of Scientific Societies or to a library at headquarters if this be in the London district.

The site is of an adequate size for the whole of the A.R.D. The cost of transference to this site would, however, be of the same order as to a new site. The buildings are of a specialised character, unsuitable to adaptation for laboratories or for conversion to the manifold activities of the A.R.D. The roads and drainage and the workshops and stores could probably be made the basis of an establishment, but the majority of the site

would have to be levelled, to take the new buildings which would be required

The fundamental and manufacturing groups require laboratories and facilities for experimental manufacture, none of which are available on the site.

(b) Elstow R.O.F.

This site is occupied by large buildings used in the production of heav armament, and a preliminary investigation showed that the buildings were entirely unsuitable for conversion to A.R.D. requirements. It is considered that this site showed no advantage over Burghfield and in certain respect was not so suitable.

(c) Waltham Abbey R.G.P.F.

This is an Ordnance Factory which has been engaged on the production of all kinds of explosives. It occupies about 500 acres, and is divided into two parts, the north and south sites. The latter (about 250 acres) has been examined with a view to determining its suitability for the needs of the fundamental and manufacturing research group. A survey of its possibilities for this purpose has been made.

7. ADVANTAGES OF WALTHAM ABBEY R.G.P.F.

This factory is within easy reach of the centre of London and of the Royal Arsenal, Woolwich. There is a standard gauge railway into the factory with narrow gauge connections to the buildings, most of which could be utilised. The factory is also connected with the waterways of the country. Services for steam electricity, gas and water are laid on throughout the factory. An effective scheme has been developed to deal with factory effluents.

Suitable canteens, workshops and stores are available. The buildings which are suitably placed to cover safety regulations, are substantial and in good condition. They are in brick, cement bonded, and could be adapted where required to laboratories and other purposes. There are buildings which could be used for administration, but it might be desirable at a latter date to construct a new administrative building.

There are good technical schools within a reasonable distance. The present industrial staff, which it would be desirable to retain, has been trained in the handling of explosives.

(a) Manufacture.

The buildings necessary for the experimental manufacture of propellants and high explosives are already in existence and attention is directed to a

modern acid recovery plant already linked up with process buildings and an RDX plant which is readily adaptable to the manufacture of other high explosives. Other buildings are available for the manufacture of nitroglycerine and nitrocotton. There is ample magazine and stoving accommodation.

Experimental manufacture of propellants for guns and plastic propellant is at present carried out by the staff of the RGPF for the A.R.D. on the North side of the factory.

The facilities available would provide a valuable starting point from which the A.R.D. could build up experimental manufacture up to full scale. The necessary plant is either in the factory or could be made available from other factories when production diminishes.

(b) Laboratories

Suitable buildings exist on the site which could be adapted for use as analytical and propellant laboratories. It would, however, ultimately be necessary to build organic and physico-chemical laboratories. There are a few laboratories which could be used as ancillary to manufacture.

(c) Climatic huts.

In research on the safety and stability of munitions, large numbers of climatic huts are needed. There are available on the site many mounded buildings which could be adapted for this purpose.

(d) Transference of outstations to Waltham Abbey.

By adaptation of buildings, accommodation could be provided in a reasonable time for the transference of the analytical, propellant and physical chemistry sections. This would permit of the return of a number of outstations to Woolwich or Fort Halstead and would give the necessary freedome to re-arrange the sections of the A.R.D. according to a plan which would improve ease of administration.

8. RELATIONS WITH THE GROUPS WORKING ON APPLICATIONS OF EXPLOSIVES.

The full proposals for the organisation of the A.R.D. will probably include two groups dealing with applications of explosives, one concerned mainly with Heavy Armament (large calibre guns, shell and bombs) and the other with Light Armament (small arms, fuzes, etc.)

The first of these will require firing ranges suitable for large calibre guns and the possible sites in this country are limited. Woolwich is indicated as the site for this work at any rate for the immediate post-

war period.

The second could probably be satisfactorily housed at the present headquarters of the Department at Fort Halstead. Moreover, it is highly desirable that the present close contacts with the Design Department on this site should be maintained, and every facility provided for the development of fuzes and light armament, which could suitably be carried out there.

If these considerations lead to the retention of Fort Halstead and Woolwich, it is highly desirable that the group dealing with explosives should not be far distant. Geographically Waltham Abbey provides a reasonably satisfactory solution.

9. PROPOSALS FOR IMMEDIATE POST-WAR PERIOD

While it would be preferable to re-assemble the whole of the ARD on one site, with facilities adequate to its manifold activities, the following proposals are put forward as a practical solution for the immediate post-war period.

The proposals fall into four stages:-

(1) Continuance of existing facilities for experimental manufacture of propellants at R.G.P.F. Waltham Abbey.

(2) The utilisation of the buildings and other facilities at R.G.P.F., Waltham Abbey for the establishment of an A.R.D. Station on experimental manufacture of explosives. Existing buildings on the south side could be adapted to experimental manufacture of HE and intermediates.

(3) The transference of the analytical section from Swansea and the propellant section from Woolwich to buildings on the R.G.P.F. site which could be adapted as laboratories.

(4) The creation in due course of a research group at R.G.P.F. Waltham Abbey to deal with the fundamentals of explosives up to the manufacturing stage.

Proposals (1), (2) and (3) could if desired be carried out independently, and if implemented would make it possible to satisfy the most urgent needs of the A.R.D. for the return of staff from Outstations. They do not commit the Ministry to the implementation of scheme (4), if any more practicable arrangement be forthcoming in the near future.

10 RECOMMENDATIONS

It is recommended that consideration be given to the transference of R.G.P.F. Waltham Abbey to the A.R.D. in order to meet the requirements set

out in para. 9. These are:-

(i) the continuance and extension of existing experimental manufacture of Propellants.

(ii) the provision of facilities for the experimental manufacture of Explosives.

(iii) the provision of accommodation for the re-assembly of certain of the Outstations of the A.R.D.

(iv) the formation of a unified group to deal with fundamental research on Explosives.

A list of names of staff required for (i) has already been submitted. A further list of staff required for (ii) will be submitted shortly.

APPENDIX I.

RESEARCH ON THE MANUFACTURE OF EXPLOSIVES

A.1. The research of the A.R.D. on the experimental manufacture of explosives dovetails with that of the production factories and a close liaison between the two research groups should be maintained for efficient working. The dispersion of the land service and naval factories over the country, and the specialisation in manufacture at these factories, makes geographical proximity impracticable. It is important, however, that research in experimental manufacture be carried out in close proximity to the fundamental applications.

If there is to be a geographical separation between production and research then it is submitted that the best division of function would be that (a) the A.R.D. should carry out research on new processes, and (b) the Ordnance Factories, research on existing processes. There would of necessity be some overlap but this would be minimised if good liaison were established between the two sets of workers. In peace-time it may be desirable that the major part of the research be concentrated in the A.R.D. It is, however, submitted that the facilities available to the A.R.D. should be extended so that, (a) the new processes could be developed to a further stage than at present before transfer to the factories and (b) the research could range over a wider field of topics. The facilities and staff required for a commencement of this plan are very largely available at Waltham Abbey R.G.P.F.

A.2. Pre-war Organisation.

The relations between the A.R.D. and its parent organisation at

Waltham Abbey R.G.P.F have been very close over many years, and processes developed in the A.R.D. on a pilot scale have been transferred to Waltham Abbey for the study of experimental manufacture. The development of RDX manufacture was carried out in this way. Manufacture of propellant for the larger guns which could not be carried out in the experimental factory at Woolwich without serious hindrance to research was also carried out at Waltham. The R.G.P.F. has been gradually closing down its activities, but DGX has made arrangements for the continuance of the previous facilities. It would be a serious handicap for the development of explosives by the A.R.D. if these facilities were withdrawn.

At the beginning of the present war, there was much extemporisation in the provision of manufacturing processes, although excellent work was done in starting up the high explosives and propellant factories with the limited means that were to hand. The lack of preparation before the war has led to waste of resources and delays in manufacture which, with more adequate planning, could have been avoided. The staff of the A.R.D. engaged on manufacture was too limited in number and experience to provide the information or to give the services required by the factories when starting up the new processes. In particular, the absence of a section devoted to chemical engineering was a great weakness in the organisation.

The A.R.D. had concentrated its efforts mainly on the development of the manufacture of RDX and on the production of flashless picrite propellant Much that could have been done on the introduction of new high explosives an on new ingredients for propellants has had perforce to be left to explosives chemists in Canada and U.S.A.

A.3. Extra-mural teams.

It was realised at the beginning of the war by D.E.R. that the staff of the A.R.D. was inadequate to cope with the problems of manufacture which would be raised by the operation of new processes in the North and West of the country. Extra-mural teams were started at Bristol and Glasgow Universities to assist in research on current problems of the explosives factories and co-ordination between these teams, the factories, the A.R.D. and I.C.I. was effected by the TNT, Tetryl and RDX Panels. This was not an ideal arrangement, but was perhaps the best that could be done under the circumstances. It, however, left the A.R.D. with few direct contacts with the H.M. factories. This arrangement was, however, responsible for much good work on the development of the continuous TNT process, on the RDX process and led to the development of a new continuous process for Tetryl.

A.4. The use of R.G.P.F. for development during the present war and for post-war development.

It is hoped that the present arrangements for experimental manufacture at R.G.P.F. can be continued and developed so as to form the nucleus of a

station on experimental manufacture. The provision of similar facilities would be difficult in the post-war years on a new site on account of labour shortages. The facilities already in existence on the South site at R.G.P.F. would enable a start to be made immediately. There is an industrial and scientific staff available at the factory which could provide the background on which development could occur. It will, however, be necessary to take prompt action to retain this staff which is being transferred or released for other work. Scientists are available from the extra-mural teams from the A.R.D. from the factories and industry, who could be employed to form a nucleus which would conserve the experience gained in this war and plan a new organisation. A parallel case is the development of Sutton Oak which started from relatively small beginnings at the end of the last war.

A.5. Experimental Manufacture requiring Development

Apart from the research on the manufacture of plastic propellant, and on the experimental manufacture of cordite for trials with guns and mortars which is now being carried out at Waltham Abbey R.G.P.F., there are a number of other researches requiring development in the near future, the more important of which are summarised below.

1. Manufacture of liquid propellants, notably methyl nitrate, and diethylene glycol dinitrate.

2. Manufacture of concentrated hydrogen peroxide by electrical discharge method.

3. Research on development of ultra fine picrite.

4. Development of RDX process, involving use of ammonium nitrate, hexamine and nitric acid.

There are a number of topics on which some work might be done involving experimental manufacture of oxamide, polymetha, diethylene glycol, fivonite, etc. which are needed either as intermediates or as constituents of explosives. Much saving of time in introduction of explosives into Service would be effected if work of this kind could be done within the A.R.D.

The DNA pilot plant at Pembrey R.O.F. could with advantage be transferred to Waltham Abbey and there is some further work needed on nitrocotton manufacture.

A.R.D. H(A) 9409/44(1)

Memorandum from Sir Robert Robinson, F.R.S., Consultant to the A.R.D.
Received 3rd November, 1944.

Proposal for an A.R.D. Technical Chemical Organisation.

During and since the last Great War I have been closely associated with the Chemical Defence and Warfare Departments of the War Office, later of the Ministry of Supply. I visited Sutton Oak frequently and am Chairman of the chemical Sub-Committee. In the course of this period of years a considerable number of new manufacturing processes of a complex nature has been evolved at Sutton Oak and I need only mention new methods of production of Mustard (in variety), Lewisite, the Nitrogenous vesicants diphenylarsine chloride and cyanide etc. etc. as well as a host of smaller products such as B.A.L., B.B.C., D.T.H. etc. When it became evident that gas warfare was unlikely to come into the picture, Sutton Oak devoted part of its potential to the preparation of a large number of chemicals required for research of national importance. This establishment was absolutely essential and has played a major part in giving us a state of preparedness of which the enemy is well aware and which I am firmly convinced is the sole reason for his good behaviour in this respect.

When I became more closely connected with A.R.D. activities it seemed a striking anomaly that the Explosives, Initiators and similar sections, so much more vital for military purposes, had no corresponding equipment and facilities. I am not unaware of the fact that in spite of this lacuna, Woolwich has indeed made notable technical contributions such as the processes for the manufacture of TNT, Tetryl and RDX. But that has been done under unnecessary and undesirable handicaps and I have frequently been told that great waste and delay has been caused by the necessary experimentation with processes on the full scale in factories. I drew attention to this matter in the course of deliberations of the Committee on Armaments Development of which I was an assessor and also at the S.A.C. I am unchanged of the opinion that a post-war A.R.D. should include ample facilities for semi-scale (and even full scale in some case development plant. Nobody can say what developments the future years will see and it would be folly to go to sleep on present knowledge and imagine that will suffice. The present types of explosives are far from perfect; special explosives and fuse compositions etc. are in constant demand and we should look forward to new methods such as the use of peroxides and liquid fuels as well as the unforeseeable. Many of the war factories and war development organisations may be given up as going concerns and as an insurance the A.R.D. should be expanded to meet all possible needs.

It is relevant to point out that one important function of the A.R.D. will be to keep a watch on new developments of the art of war in relation to the security measures adopted by the United Nations. This remark is made with special reference to the chemical aspect and unless a new body is organised for the purpose - very unlikely - the A.R.D. is the only national group that can undertake the responsibility.

There can be no doubt whatever that pilot and semi-scale plant together with adequate chemical engineering personnel is a sine qua non for efficient work. No large chemical firm ignores this necessity and why should the Nation do so in a matter of vital concern.

The question arises as to how the new Section can be brought into being. On November 27th I visited Waltham Abbey with Professor Garner and Dr. Forster and was very impressed by the ample facilities then available. It goes without saying that a site which has been used for such a variety of explosive manufacturing purposes is already equipped with the necessary services. Great floor space, strong floors and foundations, beams, pillars and cross pieces to which new apparatus can be readily attached, boilers, electricity, transport lines and very important for a chemical plant, effluent disposal and an established right to use it.

The technical personnel, men used to so called dirty work, represent valuable assets if not too rashly disbanded.

There are acid concentration plants, storage tanks and a great deal of usable junk; and of course a good machine shop.

I have no doubt that the proposed technical chemical section could be most adequately housed on this site. Indeed it would be a great waste and a sad loss of tradition to go elsewhere.

I speak with some hesitation of the larger scheme of transference of existing departments to this site. This is obviously possible but I saw only one building that could, after suitable modifications, be made into an ordinary laboratory. This could house the Analytical Department. Propellant Research and Development is already on the North part of the site and could suitably be left there for a period and later transferred to the South part of the site. Between this and the neck, there is plenty of room for administrative offices. Doubtless the boiler resources are at present too great, one boiler would probably be sufficient.

The Chemical Technical Section will need its own laboratories and there are a number of buildings which could be converted to such purposes.

APPENDIX III.

Extracts from letter by Dr. G. Rotter, Consultant to the A.R.D. on the proposal to establish a fundamental research and manufacturing research group at Waltham Abbey.

Generally speaking, I think it a very good report and the scheme finally proposed an excellent one.

Waltham Abbey has tradition. It is well-situated and would provide most of the facilities required for manufacture on both experimental and full scale working as well as for storage. I think that certain of th buildings would also make excellent laboratories. Transfer of the whole of the propellant work to Waltham Abbey would also have important advantag An enormous saving in cost would result as compared with a completely new site.