PRESTON INSTITUTE OF TECHNOLOGY

CENTRE FOR ENVIRONMENTAL STUDIES
PLENTY ROAD, BUNDOORA

ENVIRONMENTAL IMPACT STATEMENT

CONCERNING PROPOSED PREMISES

FOR THE AUSTRALIAN RADIATION LABORATORY

AT LOWER PLENTY ROAD, YALLAMBIE, VICTORIA

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ENVIRONMENTAL IMPACT STATEMENT CONCERNING PROPOSED PREMISES FOR THE AUSTRALIAN RADIATION LABORATORY AT LOWER PLENTY ROAD, YALLAMBIE, VICTORIA

TO BE PRESENTED TO THE PARLIAMENTARY
STANDING COMMITTEE ON PUBLIC WORKS

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I N D E X

1. INTRODUCTION

1.1 Summary of Findings and Recommendations

This statement assesses planning and environmental impacts associated with a proposal to construct new premises for the Australian Radiation Laboratory, on Government-owned land adjoining residential areas at Yallambie, South Watsonia, Victoria.

It appears that significant detrimental effects would follow construction of the proposed premises at Yallambie, due mainly to the following:

- probable reduction in the rate of appreciation of surrounding property values, resulting in an estimated loss of $250,000 to surrounding residents during the forthcoming 5 to 10 year period,
- failure to comply with existing residential planning patterns within the Yallambie area,
- exposure of residents to low levels of radiation, of comparable significance to fall-out from atomic weapons testing in the Pacific Ocean,
- loss of alternative potential uses of the proposed site, probably more suited to surrounding residential land use.

These objections could be overcome by locating the proposed radiation laboratory at a suitable site:

- in an area zoned for light industry,
- having ready access to Tullamarine Airport, to the Tullamarine Freeway, and hence to the majority of Melbourne hospitals.

The major arguments against these recommendations appear to be the possible cost of procurement of such a site, and the possible need for re-location of some A.R.L. staff from their homes in the South-Eastern suburbs of Melbourne. Inconvenience to A.R.L. staff would be particularly regrettable.

It is doubtful whether such considerations should take precedence over the reasonable wishes of a large number of established Yallambie residents, who consider the proposed Radiation Laboratory project to be on a scale, and of a nature, unsuited to their district.

From a procedural point of view, an assessment of environmental and other impacts by the authority responsible for a given project, could lead to omission of issues which should receive consideration by bodies representing Australian, State and local governments. It is also considered that affected residents should be consulted in the early planning stages of Australian Government projects; the presentation of a fully-planned project as a fait accompli usually intensifies any opposition which may arise.

1.2 Objectives of Proposal to Construct a Radiation Laboratory at Yallambie

Premises currently occupied by the Australian Radiation Laboratory are sub-standard, of inadequate area, and are scattered throughout Melbourne in eight separate buildings.

The main objective of the proposal is to provide the Laboratory with a single adequate, suitably located building, in which its combined functions can be fully discharged. These include:

- supply and quality assurance of radiopharmaceuticals
- standardising of radiation sources
- environmental radiation monitoring
- development and maintenance of a range of associated mechanical and electronic equipment

The necessity for adequate premises for the Laboratory, and the importance of its functions to the community, are not at issue. The only matter in question is the relative suitability of the site selected for the proposed new premises.

1.3 Nature of Proposal

This is fully described elsewhere.[1,2,3] In summary, it is proposed to construct a two-level administrative block, flanked by two wings housing scientific and technical laboratories.

Total anticipated staff upon completion of the building would be approximately 90.

Cost of the project in early 1974 was estimated at $3.25 million.

Parking on site for 90 vehicles would be provided, with accommodation for 30 additional vehicles if needed.

Gross area of the proposed building complex is 7850m^2 (84500 ft^2), plus 930 m^2 (1000 ft^2) of under-floor access space; this represents approximately 25% of the site area.

Future building expansion, proposed to cater for anticipated growth between 1980 and 2000. would add an additional 7400m^2 (80,000 ft^2); approximately 50% of the 8-acre site area would then be occupied by buildings, with much of the remainder under bitumen-surfaced car parks and road pavement.

External finish to the building would consist of exposed aggregate infill panels, coloured aluminium windows, and precoloured steel deck roofing.

Landscaping works would include development of the building surroundings as a natural parkland, with a wide strip of impenetrable Australian shrubs in lieu of security fencing along the site frontage. Car parking would be screened by a 2m high planted mound. Perimeter fencing, although not specified, appears to consist of a high wire-mesh security fence (refer dwg. no.7, reference no.2), which appears to run along the boundary of residential properties in the adjoining Yallambie estate.

1.4 Site Location

The proposed site, of approximately 3 hectares (330,000 sq.ft., or approximately 8 acres) is located at Yallambie, south Watsonia, 16 km (10 miles) north east from Melbourne.

The site is bounded on the south wide by Lower Plenty Road; along its eastern boundary lies Yallambie residential estate, with several hundred homes.

A horse-riding school currently uses the site, which occupies the south east corner of the 440 acre Watsonia Army Camp property.

1.5 Reasons for Impact Statement

Preston Institute of Technology has been briefed to prepare an Environmental Impact Statement (E.I.S.) by the Yallambie Progress Association, representing residents concerned at the proposal to construct premises for the Australian Radiation Laboratory in close proximity to their homes.

An E.I.S.[3] has already been prepared by the Australian Department of Health, which is the requesting authority for the new Radiation Laboratory. The Department's assessment of its proposal is as follows:

"As a result of investigations made, the Australian Department of Health and the Australian Department of Works believe that the establishment of the proposed laboratories will provide services of benefit to the community and will not have any detrimental effects on the environment."[4]

The following bodies[5] have viewed the above E.I.S., and have no objection to the proposal:

- Australian Department of Environment and Conservation
- Australian Department of Urban and Regional Development
- Victorian Ministry of Conservation
- Victorian Environment Protection Authority
- Victorian Department of Health
- Melbourne and Metropolitan Board of Works

Yallambie residents, however, have requested that an independent study be made of the proposal. A grant has been made available by the Department of Environment and Conservation for this purpose.

The Councils of the Shire of Diamond Valley, Shire of Eltham and the City of Heidelberg have also requested further information on certain aspects of the proposal.

1.6 Reasons for Residents' Concern at Possibility of Radiation Exposure

Both within and without Australia, the issue of radiation safety has received wide publicity. Public concern at small additions of ionising radiation to the environment has generally been proven to be well founded.

In the United States, for example, Lewis (1973)[6] reports that the Atomic Energy Commission (A.E.C.) had adopted as its permissible radiation emission standards, the recommendations of the Radiation Protection Guide (1960) of the now-defunct U.S. Federal Radiation Council. Based on risk-benefit judgements of that time, the Guide established a maximum annual exposure of 500 millirems (mr) for individuals, and 170 mr for the average per capita dose to a population. (For comparison, the annual background per capita radiation exposure is approximately 100 mr). Since 1969, E.J.Sternglass, J.W.Gofman, A.R. Tamplin and other radiation experts had argued that these levels were too permissive. However, the A.E.C. generally resisted attempts to reduce radioactive pollution emission levels. In December 1972 the National Research Council on the Biological Effects of Ionising Radiation (BEIR) issued a Report[7] which found, inter alia, that an additional 6000 cancer deaths throughout the U.S.A. could result if the "safe level" of 170 m rem/year were reached. In June 1971 the AEC, under public pressure, had proposed a reduction of radiological discharges to about 1 per cent of those contained in the Radiation Protection Guide.

In Australia, much publicity has been given to health hazards arising from radioactive fallout due to atmospheric nuclear weapons testing in the South Pacific Ocean. The Australian Government has accepted and acted on the findings of a Report (1973)[8] by the Australian Academy of Science, dealing with the biological effects of fallout over Australia from French atomic testing. Using official figures for radiation dose levels in Australia due to French tests up to and including 1972, the Academy has stressed that "despite the uncertainties outlined in their

discussion of biological effects, the only prudent course in attempting to assess the overall risk to the Australian population was to assume direct proportionality of all biological effects to radiation dosage. Such a linear relationship with the dose received would suggest, using maximum published figures for radiation risks, that past French atomic tests could (I stress, could) produce a final figure of 26 cases of thyroid cancer and 14 cases of leukemia and other cancers in the Australian population. Further, as a result of French tests that have already taken place, there could be approximately one death or serious disability in Australia from genetic causes during the first generation, and up to 18 deaths in all subsequent generations." (Robertson, 1974)[9]

The Australian Government clearly does not accept this small per capita maximum risk to the Australian population, and has strongly opposed the continuation of such testing in the atmosphere. As a result, the French Government has recently undertaken to conduct future atomic weapons testing underground. Consequently, the climate of public opinion generated within Australia is one of strong antipathy to any exposure to low levels of ionizing radiation.

2. OBJECTIVES OF IMPACT STATEMENT

2.1 Terms of Brief

The objectives of this E.I.S. are to estimate, where possible quantitatively, a number of effects which could be associated with the proposal to construct premises for the Australian Radiation Laboratory at Yallambie. These are as follows:[10]

1. Possible risks to adjoining residential areas from routine liquid, solid, gaseous and particulate airborne emissions. Assessment of the effects of non-radioactive routine emissions (solid, liquid, airborne, and noise).
2. Possible risks arising from accidental release of radioactive materials to the environment.
3. Possible risks involved in transportation of hazardous radioactive materials, products and solid/liquid effluents to or from the proposed site. Possible traffic increases - effect on surrounding district.
4. Ecological significance of the proposed land : does its proposed use involve the avoidable loss of significant vegetation, birdlife or related resources?
5. Aesthetic and valuation impact of a large industrial facility on surrounding residential areas. Possibility of future extension of the proposed facility, or addition of other industrial plants.
6. The possibility of contravention,at least in spirit, of prevailing urban planning zones within the district.
7. Possible disposal of hazardous liquid or solid wastes to tips within the area.
8. Assessment of seismic risk at the proposed site.
9. Possible contravention of the reasonable wishes of residents who do not wish to live in proximity to potentially hazardous industrial undertakings.
10. Possible alternative locations for the proposed facility.
11. Any further matters relevant to the establishment of a radioisotope facility at or near the proposed site.

2.2 Attainment of Objectives

The various terms of the Centre's brief have been entrusted to appropriate specialist staff within the Institute, and to a number of expert consultants outside the Institute (refer Appendix 1).

These persons have inspected the proposed site, and,where appropriate, have visited existing Australian Radiation Laboratory premises. Discussions have been held with its Director (Mr.D.J.Stevens) and senior staff. A list of questions has been submitted to the Laboratory, and detailed replies obtained (refer Appendix 2).

The Centre wishes to acknowledge the full and complete co-operation accorded its representatives by the Director and staff of the Laboratory.

3. ASSESSMENTS OF IMPACT

3.1 Risk of Radiation Exposure (Refer Appendix 3.)

In estimating this potential risk at Yallambie, it seems reasonable to examine, and compare, other examples of risk estimates for exposure to low levels of ionizing radiation in Australia. The best-known example is perhaps the public health hazard arising from radioactive fallout over Australia since 1967, following testing of fission and fusion weapons by France in the South Pacific Ocean.

3.1.1 Comparison between maximum health hazard at Yallambie, and maximum health hazard from atmospheric weapons testing fallout

The maximum genetic risk to Australians from French fallout up to and including 1972, is one death or severely defective birth per generation per 14 million persons,[9] i.e. a per capita risk of 7×10^{-8} in the first generation. The maximum risk of thyroid cancer from the same cause[9] is estimated at 26 cases in 14 million persons, or a risk of 1.8×10^{-6} per person. The maximum risk of all cancers is 40 in 14 million persons, or 2.8×10^{-6} per person, during the 7-year period 1965-1972; this is a cancer risk of 4.0×10^{-7}/yr/person.

In one estimate of risk at Yallambie (refer Appendix 3, S.3.3) it is assumed that a population of 1000 persons in the Yallambie district could be exposed to a dose rate not exceeding 5 millirem/year (1% of the NHMRC recommended level of 500 mr/yr for non-occupationally exposed personnel, this being the proposed upper limit of exposure for persons at the site boundary, adopted by Australian Health Department in its E.I.S.[18]). The Yallambie population exposure could then be 5 man-rem/yr., leading to a cancer risk of 10^{-6}/yr per person, which is an order of magnitude greater than the per capita risk due to French fallout.

However, there are large uncertainties inherent in risk estimates based on the most pessimistic assumptions, which cumulatively maximise the hazards arising from extremely small radiation exposure levels. The most reasonable comparison between hazards due to atmospheric fallout, and to a Radiation Laboratory at the proposed site, would therefore be:

- That the public health risk to the Yallambie population, due to Radiation Laboratory activities, would be of a similar order of magnitude to the public health risk arising from atmospheric nuclear testing in the South Pacific Ocean.

3.1.2 Upper estimates of population exposure to radiation at Yallambie

Appropriate Sections are quoted from the Australian Health Department's Environmental Impact Statement[3]:

S.6.3.4 Dosimetry and Sealed Sources Sub-Section:-
Exposure to persons "at the boundary of the site" due to x-ray equipments and sealed radioactive sources will not exceed .01 of dose limits recommended by A.N.H.M.R.C. (See also p.2. of Appendix 2).
Assume maximum dose to residents - 1 mr/yr.

S.6.3.5 Health Physics Sub-Section:-
Maximum exposure to "members of the public and lower forms of life in the area" due to x-ray equipment, sealed and unsealed radioactive sources, sources of microwaves and of lasers"..... will result in....."an even greater reduction of any potential exposure". Assume maximum exposure to residents.....1 mr/yr.

S.6.3.8 Radiopharmaceutical Sub-Section:-
"In this sub-section, bulk supplies of radioactive materials in an unsealed form are used"..... "The amount of radioactivity involved and its nature both pose potential problems as an external source of radiation exposure and also as a source of environmental release of radioactivity".

Also, radioactive emissions to atmosphere from exhaust flues "will be reduced to below the levels prescribed in the Victorian Radioactive Substances Regulations by the use of appropriate filter systems....."

Also:...."Any radioactivity that might be released to the atmosphere would therefore be only at a minute fraction of the maximum permissible concentrations in air set either by the Victorian Regulations, or the Recommendations of the I.C.R.P.". (refer p.7. Appendix 2).

Also:...."With the use of filters in the exhaust system in the proposed laboratory premises at Yallambie, the concentration (of radioactive contaminants exhausted to atmosphere) would be only a minute fraction of any levels laid down by either the (Victorian) Regulations or the I.C.R.P. Recommendations". (refer Appendix 2, p.8).
Assume maximum exposure to residents .....3 mr/yr.

3.1.3 Conclusions

It appears that, despite all shielding, filtering and other measures, there would be some small exposure of nearby Yallambie residents to radiation and radioactive emissions from the proposed laboratory.

For the purpose of locating the Laboratory at Yallambie, it is assumed by the Australian Departments of Health, Works and Housing, Urban Affairs* and Environment and Conservation, that this exposure is negligibly small, and would cause negligible risk to residents' health within the district.

However, as Yallambie residents point out:[19] "No exposure to ionizing radiation should be permitted without the expectation of commensurate benefit"[20]
Also:...."it should be emphasized that, in our opinion, there should be no unwarranted exposure to radiation".[21] This recommendation, quoted from the Australian Academy of Science Report to the Prime Minister, has been accepted, and acted on, by the Australian Government.

The functions of the Australian Radiation Laboratory are unquestionably resulting in "commensurate benefit" to the Australian population at large. However, it does not necessarily follow that any single residential community should experience the extremely small hazard, and considerable public anxiety, now associated with exposure to low levels of ionizing radiation.

The main points in the radiation issue may therefore be summed up as follows:

(i) The public health hazard associated with exposure to the low levels of radiation which would accompany the operations of the Australian Radiation Laboratory at its proposed site at Yallambie, may be assessed either as negligible, or as significant. Considerable expert published opinion may be marshalled in support of either point of view.

(ii) Widespread and strong public concern undoubtedly exists, where any long-term exposure to low levels of ionizing radiation either exists or may arise.

*erratum: for "Urban Affairs" read "Urban and Regional Development".

(iii) The Australian Government has, to date, strongly supported the view that any avoidable exposure to low levels of ionizing radiation, even though a minute fraction of natural background radiation, constitutes a significant hazard to public health and should be prevented by all means available.

(iv) It therefore appears unwise that the Australian Government should plan for the construction of a major Radiation Laboratory at a site within, or adjoining, any residential area.

3.2 Planning Considerations

Refer Appendix 4.

3.2.1 Departure from existing planning scheme

Although not legally obliged to comply with planning controls, the Australian Government could reasonably be expected to develop its properties in ways consistent with adjacent land users' expectations for the overall development of their area, as implied by the existing planning scheme (M.M.B.W. Melbourne Metropolitan Planning Scheme - refer Map No.53 in Appendix 4).

At Yallambie, the pattern of development is clearly residential. Purchasers of properties at Yallambie would have every reason to assume that the Army's land at Watsonia would eventually be used for residential development, or for associated uses (public open space, schools, shopping, etc.). All undeveloped lands adjoining the Watsonia Military Camp are zoned "Residential C" or "Reserved Living" (ref.MMBW Map No.53), and will undergo residential development.

The proposed Radiation Laboratory would represent a radical first departure from the existing planning scheme, for the following reasons:

- visual intrusion: scale of development, type of construction, difficulty of landscape screening (Appendix 4, s.3)
- traffic considerations: inadequate public transport and road facilities, and increasing traffic volumes (Appendix 4, s.4). There is much doubt that proposed road improvements will occur on the scale, or to the timetable suggested in References 1, 2, and 3.
- possibility of repetition of flooding to homes along the nearby creek, due to rapid runoff from the large proposed roof area at times of heavy rain (Appendix 4, s.5). Extensive paved areas (roads, car parking) would tend to increase this problem.

An estimate of the total or "real" cost of the proposed laboratory to the community must include:

- Loss of potential valuation appreciation (refer S.3.4, and Appendix 5)
- Loss of opportunity for alternative site uses of a residential character, including open space.

3.2.2 Possible Alternative Use for Site

The only open space within ready walking access for children of the Yallambie district, is a strip of land along the Plenty River, zoned "Proposed Public Open Space". The proposed A.R.L. site includes portion of a small watercourse which, if replanted and restored, could provide a focus for a most attractive and valuable parkland belt, leading to the relatively undisturbed area of Eucalyptus/Themeda grassy woodland (see Map No.53). Conservation of watercourses, rather than their destruction by barrel draining, has become a major aim of prominent landscape planners, including I.McHarg,[11] W.Whyte,[12] P.Lewis,[13] in the United States, and, on the local scene, Ellis Stone.[14]

The Land Conservation Council has supported widespread public opinion in calling for the setting aside of additional recreational land in and around Melbourne.

As Yallambie residents point out,[15] the Australian Government has a responsibility to the community to ensure that land held in trust for the community is put to the most appropriate use, with regard to the needs of the surrounding community.

It is doubtful whether the construction of a Radiation Laboratory, employing 90 staff members, on the site in question, when there is no shortage of land zoned "light industrial", represents the most appropriate use for the subject land.

It should also be noted that the sale of the proposed site (approx. 8 acres) for housing development, would realise perhaps $100,000 for the unsubdivided land. Presumably this could offset the cost of obtaining an alternative site in an area zoned for light industry, should Government-owned land be unavailable.

3.2.3 Precedent

It is also considered likely that the proposed Australian Radiation Laboratory would establish a precedent which could be used by the Australian Government as justification for locating other technical or light industrial developments, on a similar or larger scale, within the southern portion of the Watsonia Military Base. It seems possible that this entire area could ultimately be developed by the Australian Government as a major scientific/technical/administrative complex, with associated large work force, heavy traffic, large buildings and a high degree of activity, all normally foreign to a residential district.

A statement of intention from the Australian Government regarding future development of the Watsonia Military Base seems appropriate, in view of the present "open government" policy, and in view of Yallambie residents' concern with the future development of their district.

3.2.4 Loss of amenity due to location in residential areas elsewhere

Consideration has been given by the Australian Health Department to alternative sites at Bundoora, Keilor, Campbellfield and Essendon Airport.

The most favorable of three sites at Essendon Airport is bounded by the Tullamarine Freeway, First Avenue, and Carnarvon Road. This site has been considered unsuitable because "the site is at present used as parkland and is in a built-up residential area. It is anticipated that a laboratory may be considered an unsuitable amenity to the area."[16]

Similar considerations may apply with equal force to the proposed Yallambie site, which is in use for community recreational education (horse-riding), and abuts directly upon the Yallambie residential estate. At Yallambie, however, no street or other buffer area exists to provide a degree of isolation from the proposed Radiation Laboratory site.

It must be emphasized that the Yallambie residential population, includes a high proportion of young children, who are at greatest risk due to any possible release of thyroid-concentrating radio-iodine isotopes; also, persons below 30 years of age (the pre-reproductive and reproductive age groups), whose radiation protection requirements are greatest.

3.3 Effect on Property Valuations

Refer Appendix 5

The services of a highly qualified and experienced consultant have been obtained to estimate the impact of the proposed Radiation Laboratory on surrounding property values.

It is considered that surrounding property values would be detrimentally affected within a radius of one-half mile (800 metres) of the Radiation Laboratory, for two reasons:

(i) The proposed building is of"a semi-industrial research and development nature", which would lessen the visual appeal of the area, cause higher traffic densities, and result in loss of buyer appeal among surrounding properties.

(ii) In the climate of public opinion following considerable adverse publicity given to the hazards of low-level radioactive fallout from nuclear weapons testing, the presence of the Australian Radiation Laboratory would detract from the desirability of the area for prospective buyers of homes or land.

The result would be "that the surrounding properties will not increase in value to the same extent as they would in the future if the present use was maintained on the site". Also, "any increase in value will be not as great as comparable residential property in other locations". (vide Appendix 5, pp.3-4).

There are several hundred homes within the specified zone of diminished valuation appreciation. Assuming 500 properties to be affected, with an average $500 loss of appreciation per property, it may be estimated that construction of the Radiation Laboratory at the proposed site could result in $250,000 loss in potential property valuation. This could further result in considerable loss of rating revenue to the City of Heidelberg and the Melbourne and Metropolitan Board of Works.

It is doubtful whether the cost of locating the Radiation Laboratory at an alternative site would exceed the estimated reduction in Yallambie resident property values.

3.4 Ecological Impact

Refer Appendix 6.

The proposed site is of no particular ecological merit, although plantings of Eucalyptus camaldulensis are worthy of preservation, where possible.

It is noteworthy, however, that the few acres of elevated woodland immediately north of the proposed site contains a reasonably intact remnant of the original overstorey and ground flora. This area would, if conserved, be of great value as public open space to the surrounding residential district.

3.5 Seismic Risk Assessment

Refer Appendix 7.

It was felt that the presence of holding tanks, to contain radioactive liquids, warranted an estimate of the low probability of an earthquake capable of breaching such tanks.

Records suggest that earthquakesof intensity greater than 6.5 may be anticipated "at average intervals greater than 50 years", at any point within the Melbourne/Westernport Bay zone.

On the modified Mercalli scale, the effects of an earthquake of intensity 7 include the dislodgement of plaster and roof tiles, falling of chimneys, and difficulty in standing.

Design of radioactive liquid holding tanks, and radioactive storage areas, could allow for the small probability of seismic damage.

3.6 Meteorological considerations

Refer Appendix 8.

The opinion of a meteorologist resident in the Yallambie area (see Appendix 8), is that local atmospheric conditions commonly result in a low level inversion across the site, often visible due to the trapping of a layer of fog across the proposed site, and along a local valley system containing many residents' homes.

The Commonwealth Bureau of Meteorology has confirmed[22] that air pollution problems in valleys are aggravated by two factors:

- valleys are sheltered from winds
- pooling of cold air in valleys intensifies atmospheric stratification, preventing vertical dispersion of pollutants.

It can be assumed, therefore, that Air Pollution Potential (A.P.P.) in the valley system of the Yallambie District is considerably greater than the only A.P.P. values published for the Melbourne area as a whole, based on measurements taken at Laverton.[23]

An extended meteorological survey would be required at Yallambie, to obtain sufficient data concerning mixing depth (vertical depth of the atmosphere through which pollutants disperse), ventilation wind speed within that layer, and related data. This would permit a reasonable estimate of A.P.P. factors, which should be taken into account when planning the location of industrial or semi-industrial projects within a residential district.

3.7 Other Considerations

3.7.1 Risk of Fire Outbreak

There is an additional very small but finite risk of exposure to radioactive isotopes (in particular Iodine 131 - refer Appendix 3, S.6.4), which would be volatilised and released to atmosphere in the unlikely event of a major fire in the Laboratory. It is possible that a Yallambie resident could be exposed to about 10,000 times the maximum permissible concentration in air of iodine 131, alone, during the hour following a major outbreak of fire in the proposed laboratory.

This risk would be additional to that due to routine emissions, discussed in S.3.1.

3.7.2 Disposal of Radioactive Liquid Wastes

Dilute solutions of relatively short half-life radionuclides are to be discharged to the M.M.B.W. sewer from the proposed site. Any possible reconcentration in river biota, or bottom muds, is unlikely to result in measurable radiation exposure to persons taking water, fish or bottom sediments from the Plenty River below the Lower Plenty Purification Plant outfall. (Refer Appendix 3, S.5.3).

3.7.3 Disposal of Radioactive Solid Wastes

No definite information is available regarding methods of disposal or storage of low level and high level radioactive wastes "at a site remote from Yallambie." (Refer Appendix 3, S.5.1).

It is assumed that such disposal or storage is carried out under proper supervision, according to prescribed techniques, in areas where no accidental recovery of the wastes is possible. There should then be no risks to Yallambie residents or to other members of the public.

3.7.4 Transport of Radioactive Materials

At the present scale of operations, it is estimated that 12 vehicle movements per day involving radioactive materials would occur. (Refer Appendix 2, Question 9.1).

It is considered that the daily transport of radioactive materials through the Yallambie area, and along heavily-trafficked roads (Bell Street, Heidelberg Road), would be somewhat inappropriate, when sites with ready access to the Tullamarine Freeway[16] are available to the Australian Government.

However, provided that transport of such materials at all times complies with the prescribed codes (refer Appendix 3, S.6.2), there should be negligible risk to Yallambie residents and other road users.

3.7.5 Noise

The present functions of the proposed Laboratory do not appear likely to expose surrounding areas to noise of a non-residential character.

However, during periods of construction and extension of the proposed buildings, there would presumably be some periods during which noise due to jackhammers, excavators and other heavy machinery would occur.

No estimates of noise arising from developments subsequent to the Radiation Laboratory is possible, as nothing is known regarding the nature of such developments.

3.7.6 Licencing of Emissions

No information is available concerning licencing requirements (refer Appendix 2, question 1).
The Victorian Environment Protection Authority appears to have no legal powers over Australian Government projects in Victoria, although it would be expected that emissions from Australian Government projects would comply with existing regulations governing these matters.

However, there appears to be no requirement for Australian Government Departments to submit detailed applications for Licences to discharge wastes to water, air, and land. Such licence applications are the only safeguard available to ensure that types and quantities of emissions are properly controlled.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 Exposure of Residents to Radioactivity

Residents within areas adjacent to the proposed site would be exposed to additional low levels of ionizing radiation, of similar order of magnitude to radioactive fallout from nuclear weapons testing in the Southern Hemisphere atmosphere. Much expert opinion can be cited to support either the view that the resultant health hazard is negligible, or that it is significant. The Australian Government has to date supported the latter position.

4.2 Planning Considerations

The scale and nature of the proposed Radiation Laboratory are such that it would be out of character with existing and pending residential development of the district. The resultant loss of amenity would reduce the rate of appreciation of property valuations in surrounding areas.

4.3 Precedent

It seems likely that this first intrusion of a non-residential character into the southern portion of the Watsonia Military Base, would be followed by similar developments, quite possibly on an even larger scale.

4.4 Alternative Uses of Site

The proposal would involve the barrel-draining of a small water-course, and poses a threat by precedent to a surviving area of Eucalyptus/Themeda grassy woodland to the north of the proposed site. Such community resources should be retained as public open space, and restored where necessary.

4.5 Recommendations

4.5.1 The Australian Radiation Laboratory should be built at a site in an area zoned for light industry or similar activities. The site should be separated from residential areas, and should have closer and safer access to Tullamarine Airport and Melbourne hospitals; the Tullamarine Freeway would appear to provide such access. The area chosen should have low A.P.P.

4.5.2 The Australian Government should provide a statement of intentions to Yallambie residents, setting out its plans for future development of the Watsonia Military Base.

4.5.3 The Australian Government should enter into early consultation with residents likely to be affected by plans to construct large-scale developments in close proximity to their homes. It should not carry out expensive planning to final stages, and obtain approval from State and local instrumentalities, without prior consultation with those who must bear any adverse effects of the proposal.

4.5.4 Should the Australian Radiation Laboratory be constructed at the proposed site at Yallambie, despite all of the above considerations, the various Recommendations regarding additional radiation safety measures (included in Appendix 3) should be observed.

4.5.5 Where Australian Government projects emit wastes to air, water or land, such emissions should be subject to the same licencing requirements as are all State and private industrial and semi-industrial undertakings. This would avoid the situation where an Australian Government project sets, monitors and guarantees its own levels of emissions, subject to no external check.

4.5.6 Where an Australian Government Department is the proponent authority for any project which may have significant environmental consequences, that Department should be required to obtain an E.I.S. from an independent organization, in addition to (or in lieu of) the mandatory E.I.S. submitted to the Australian Government by the proponent authority. Amending legislation to this effect should be introduced into Parliament at the earliest opportunity.

REFERENCES

1. Australian Department of Health (1974). *Statement of Evidence to be presented to the Parliamentary Standing Committee on Public Works: Proposed Premises for the Australian Radiation Laboratory at Lower Plenty Road, Yallambie, Vic.* (Departmental publication).

2. Parker, S. (1974). *Proposed Premises for the Australian Radiation Laboratory, Lower Plenty Road, Yallambie, Vic. Drawings and Evidence, presented by the Australian Government Department of Housing and Construction* (Departmental publication).

3. Australian Department of Health (August, 1973). *Environmental Impact Statement : Proposed Premises for the Australian Radiation Laboratory and Australian Dental Standards Laboratory at Lower Plenty Road, Watsonia, Victoria.* (Departmental publication).

4. ibid. p.24.

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APPENDIX 1

CONTRIBUTORS TO IMPACT STATEMENT

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APPENDIX 2

Comments on Information Requested by
Mr. J.A. O'Connor, Lecturer in Environmental Studies,
Centre for Environmental Studies, Preston Institute of Technology
in Appendix 1 attached to a letter dated, 17 June 1974
addressed to the Director, Australian Radiation Laboratory

Questions Pertaining to the Proposed Site for the Australian Radiation Laboratory at Yallambie, Victoria

1. Licencing Requirements

Question: Will licencing approval be sought from the Victorian Environment Protection Authority, covering proposed discharges to air, water and land? If so, could details be furnished, as required on the appropriate E.P.A. licence application forms?

Comment: Advice will be forwarded on this matter at a later date.

2. Technical Services Section

Question: Could estimates of composition, quantities involved, and details of proposed control devices (collection efficiency, supplier, model) be supplied for the following:

Question 2.1 Fumes emitted in welding/spray painting activities.

Question 2.2 Molten lead fumes.

Question 2.3 Sawdust and wood/metal shavings and fine particles.

The welding and spray painting carried out in the Technical Services Section of the Laboratory will involve a very small and an occasional workload e.g. the welding and painting of small one-off instruments which have been constructed in the Laboratory. Exhaust air from the welding/spray painting area will pass through filters with a minimum efficiency of 95% (B.S. 2831-No. 2 Dust).

The Technical Services Section of the Laboratory is not committed to a heavy workload of lead casting. The bulk of the lead casting requirements of the Laboratory is now, and in the future will be, purchased from private firms. The Laboratory will only engage in the construction of small lead castings of special character and this only at infrequent intervals.

Minimal generation of fumes from lead pouring area can be expected due to the fact that temperatures only sufficient to melt the material (less than 400°C.) are employed. To protect against release of lead fumes, exhaust air from hoods over lead melting pots will be passed through a fabric type filter/collector system with an efficiency of 99% on a particulate basis and emissions will be below the limits set by the Victorian Environmental Protection Authority. Under these conditions it is unlikely that any significant release of fumes will occur. It is proposed that monitoring for lead vapour will be undertaken using conventional methods such as those used by the Industrial Hygiene Division of the Department of Health, Victoria.

The supplier and model information requested will not be available until finalisation of tenders.

The Technical Services Section does not provide a heavy engineering type workshop, but acts as an instrument workshop for the provision of mechanical construction and repair to laboratory type equipment. Accordingly, waste materials are small.

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Sawdust and Wood Shavings - Less than half of one four gallon drum of sawdust and wood shavings will be collected in any week (but not every week).

Swarf - Less than half of one four gallon drum of swarf will be collected in any week (but not every week).

Non-ferrous metal waste - Less than half of one four gallon drum of non-ferrous metal waste will be collected in any week (but not every week).

As these volumes are small, no provision has been made for filters or for special collection facilities.

3. Dosimetry and Sealed Sources Sub-Section

Question 3.1 Could details be supplied for shielding, work procedures, monitoring and other means intended to ensure that no person at the site boundary could receive X or gamma irradiation dose in excess of 0.01 of A.N.H. M.R.C. dose limits?

Comment: Shielding materials, in the form of thick concrete walls and earth have been incorporated in the design of the building to reduce the radiation levels both to staff within the Laboratory and to members of the public outside the boundaries. The calculations for these shielding materials have been based on the maximum use to be made of radiation sources in the Sub-section and on extensive detailed information published on absorption of radiation in various materials. It is proposed to carry out monitoring to ensure this will be so. Such monitoring will not be at the boundary and thus it will not be necessary to measure levels which would be a fraction of the natural background level. The monitoring will be carried out at points inside and in close proximity to the outside of the building. From these measurements it will be possible to calculate the levels at the boundaries and ensure that these levels are below the stated value of 5 millirem per year.

The radiation beams used in the Cobalt-60 Laboratory, Comet Laboratory and AEG 50 Laboratory are so arranged that they never point towards the closest boundary (i.e. east boundary). On rare occasions, the X-ray beams in the Maximar Laboratory may point towards the east wall but the radiation shielding provided by that wall will ensure that no person at the boundary of the site could receive a radiation dose in excess of one-hundredth of the dose limits established by the Australian National Health and Medical Research Council for such persons. The above sources of radiation used in this Sub-section of the Laboratory are typical of those used in radiotherapy department of hospitals.

The Comet, A.E.G. 50 and Maximar equipments are all X-ray units which emit radiation only when electrically energised. In general, the X rays are confined to narrow beams of fixed direction. The Cobalt 60 source, a radio-active source, is housed in a steel clad lead filled container (approximately 25 cm of lead wall thickness). The housing is fitted with a "fail-safe" shutter. The gamma-ray beam from this equipment is also a narrow beam which can be orientated either horizontally towards the west wall or vertically downwards. The present activity of the source is 300 Ci.

In using and storing sealed radioactive sources concrete walls and lead shielding will be employed to ensure that no person at the boundary of the site could receive a radiation dose in excess of one-hundredth of the dose limits established by the Australian National Health and Medical Research Council for such persons.

Question 3.2 What testing or monitoring procedures are proposed for site boundary and off site radiation measurements? Will results be publicly available on request, or published at regular intervals?

Comment: Measurements will be made both within the Laboratory and immediately outside the building at a number of positions. The levels at the boundaries of the site will be calculated from these measurements and their positions relative to the boundaries. The monitoring will be made by means of suitable calibrated instruments.

The results of this monitoring will, by arrangement with the Laboratory, be available for inspection.

Question 3.3 Could details of sealed sources be supplied - identity, strength, numbers in use?

Comment: The Laboratory is responsible for the radium which is issued on loan to approved hospitals for the treatment of patients. Most of this radium is on long-term loan to those hospitals and only a small proportion is retained at the Laboratory itself to meet the changing requirements. The radium at the Laboratory will be held in a strong-room. The radium holding in the Laboratory fluctuates from time to time, but at present some 370 sources, containing approximately 1200 mg are held. It is anticipated that there will be a much smaller holding at the time of the proposed transfer to the new Laboratory premises.

The radium is mounted in medical type containers of varying activity and construction. In addition, a number of strontium 90 medical applicators has been purchased and issued like the radium, on long-term loan to hospitals. Those not on loan will be kept in the strong-room.

No repair of radium containers or of strontium-90 applicators will be undertaken at the Laboratory.

It is proposed to replace the Radon Service operated by this Laboratory in the near future. Such a Service will not operate in the proposed premises at Yallambie. As an alternative to radon there will be sealed solid radioactive sources made available for medical treatment purposes. Consideration is still being given to the most suitable type of source that might be used and it is therefore not possible to give any further indication on this at the present stage.

A few low activity sealed solid sources are used from time to time for calibration and test purposes.

Because of the fluctuations in requirements of hospitals for the use of sealed sources, it is not possible to give details of the sources which may be in the Laboratory at a particular time.

4. Radionuclide Metrology Sub-Section

Question 4.1 Identity and quantities of unsealed sources.

Comment: The unsealed radionuclides which will be handled will be the following:

^{99m}Tc, ^{99}Mo, ^{32}P, ^{131}I, ^{132}I, ^{51}Cr, ^{59}Fe, ^{58}Co, ^{198}Au, ^{47}Ca, ^{57}Co, ^{131}Cs, ^{67}Ga, ^{197}Hg, ^{125}I, ^{113m}In, ^{75}Se, ^{87m}Sr.

The activities will normally be less than 1 microcurie and only occasionally will the activity be as high as 10 microcuries.

Question 4.2 What possibility exists for formation of radioactive particulates, in particular alpha-emitters?

Comment: All unsealed radioactivity sources used in this Sub-section will be in liquid form. Only one type of unsealed radionuclide will be used at any one time and all operations will be simple wet operations until the final step which will consist of preparation of a thin solid source on a sample holder. The activity of each such source will be less than 0.1 μCi. All the above operations except for weighings will be carried out in the fume cupboard. The exhausted air from this fume cupboard will be filtered with H.E.P.A. filters (99.97% efficiency hot D.O.P. test or equivalent). No alpha emitters will be handled in this Sub-section.

Question 4.3 Details of work procedures and monitoring procedures which will ensure a safe environment for members of the public?

Comment: Refer also to comment in reply to Question 4.1 and 4.2 Conventional procedures and precautions as outlined in I.A.E.A. Safety Series No. 1, "Safe Handling of Radionuclides", 1973 edition, will be used. With the very low activities in use in this Sub-section and the work procedures employed, there is considered to be no justification for monitoring the filtered exhausted air from the fume cupboard.

Question 4.4 Types and retention efficiencies, in particular for respirable particles, of glove boxes and absolute filters used.

Question 4.5 Numbers of absolute filters involved - method and frequency of disposal. Radioactive activity of filters at time of disposal.

Question 4.6 Details of trapping and monitoring techniques used for iodine radioisotopes.

Question 4.7 Methods used to prevent escape of particulates and vapours from work area.

Comment: The activities of isotopes used in this Sub-section are all very low and only a Type C laboratory (I.A.E.A. Safety Series No. 1 "Safe Handling of Radionuclides", 1973 edition) is necessary. A Type C laboratory is a good quality chemical laboratory. The exhaust air from its fume cupboard should be carried outside the building but need not be filtered. Nevertheless, it is proposed for the air to be filtered through a H.E.P.A. filter (99.97% efficiency hot D.O.P. test or equivalent). It is not proposed to install any other filters to trap iodine vapour because of the small amounts of iodine handled in the Sub-section. The activity of the filter would be low even over a long period of time, and it will be necessary to change it due to its blocking or reducing the air flow, rather than due to its radioactivity. Disposal of filters will be discussed under comment in reply to Question 8.4.

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5. Environmental Radiation Sub-section

Question 5.1 Will atmospheric fallout samples be collected in the vicinity of the proposed A.R.L. premises?

Question 5.2 Is this being done at or near present A.R.L. facilities?

Question 5.3 If so, can the results of such sampling be made available?

Comment: The Laboratory will be sampling atmospheric fallout in the vicinity of its premises. However, this will be a developmental programme rather than one of the Australian Government fallout monitoring stations.

Monitoring of the type described above is being carried out now at the premises of the Laboratory at Maribyrnong.

The results of that developmental programme are not relevant to the present location of the major part of the Laboratory. In terms of the proposed new Laboratory, data from the monitoring which might be identified with the activities within the Laboratory will, by arrangement with the Laboratory, be available for inspection.

Question 5.4 Could details of air emission control equipment to be installed on ashing furnaces, be supplied.

Comment: Flue gases from ashing furnaces will be collected and passed through a direct gas fired after burner system to effectively break down any odourous substances which may be present. Anticipated flue gas treatment temperature is expected to be of the order of 850°C with retention time of 0.5 seconds.

6. Radiopharmaceutical Sub-section

Question 6.1 Could details be supplied for radiation shielding, work procedures and monitoring to ensure that no person at the site boundary can receive a radiation dose in excess of 0.01 of A.N.H.M.R.C. prescribed limits. What provisions are made for radiation monitoring/recording along site boundaries?

Comment: Shielding will be provided in the form of concrete walls and lead barriers. The calculations for these shielding materials have been based on the activities of radionuclides to be handled in the Sub-section and on extensive detailed information published on absorption of radiation in various materials. Should an increase occur in the activities of these radionuclides handled, the radiation protection design will be re-assessed and if indicated, further lead shielding will be provided. The comments on monitoring made in reply to question 3.2 apply to this Sub-section also. The work procedures will be in accordance with the provisions of the I.A.E.A. Safety Series No. 1 "Safe Handling of Radionuclides" 1973 edition.

Question 6.2 Could details of precautions against fire, large spillages and possible transfer of materials outside working area by contaminated personnel be supplied?

Comment: A sprinkler system is being installed throughout the building and would be activated in the event of fire. At the same time the Metropolitan Fire Brigade would be automatically warned. In addition, fire hoses and hand extinguishers are located at strategic points in the building.

Work procedures will be in accordance with the provisions of the I.A.E.A. Safety Series No. 1 "Safe Handling of Radionuclides" 1973 edition. In the case of any spillage cleaning and decontamination procedures would be put into effect immediately. Materials used for these procedures would be stored separately and disposed of as solid radioactive waste, if necessary, Monitoring of materials for disposal and of areas in which the spillage occurred would be made after the procedures had been completed. All persons and materials leaving the area would be monitored for contamination. Any radionuclide likely to be involved in a large spillages would have a relatively short half-life.

Care will be taken to ensure that contamination cannot be spread outside the immediate working area by personnel. Special protective clothing will be supplied and this will be worn only in the area where unsealed radiopharmaceuticals are being prepared. Changing areas and showers are being provided at the exit to the working area. Monitors for checking that contamination cannot be spread from the working area will be provided. Staff will be required to use these before leaving the area.

The transfer of radioactive contamination from the Radiopharmaceutical Sub-section to other parts of the Laboratory would prejudice the precision of measurement made herein.

Question 6.3 How will the release of radioactivity into the outside environment be controlled?

Question 6.4 Could details be provided for types and collection efficiencies of traps, filters etc, to be fitted to exhaust flues from glove boxes and fume hoods? What is the frequency and method of disposal of such filters/ traps?

Question 6.5 Why are the relatively permissive Victorian Radioactive Substances Regulations to be applied rather than I.C.R.P. recommended mpc's? A few examples are given:

Radioisotope	ICRP mpc (air)	Vic. Reg. mpc (air)
^{3}H	2×10^{-7} µCi/cc	2×10^{-5} µCi/cc
^{32}P	2×10^{-9} µCi/cc	1×10^{-7} µCi/cc
^{14}C	1×10^{-7} µCi/cc	5×10^{-7} µCi/cc
^{131}I	3×10^{-10} µCi/cc	5×10^{-9} µCi/cc
^{222}Ra	1×10^{-9} µCi/cc	1×10^{-7} µCi/cc

Comment: One of the functions of this Laboratory is to carry out assays on a wide range of environmental samples, foodstuffs, water etc. to determine the radioactivity in them due to naturally occurring radioactive materials and to man-made sources, such as fallout from nuclear weapons tests. It is therefore imperative that any radioactive contaminants which could be emitted to the environment be reduced to as close to zero levels as possible to avoid their introduction into that Section of the Laboratory where such determinations are made. Any such contaminants could be easily detected by the highly sensitive apparatus used for the environmental monitoring programmes and they could then throw into doubt the results of all such monitoring.

The radioactive materials used in this Sub-section are mainly in liquid form, although a small number of solid sources pass through this Sub-section for distribution to users. These latter sources are sealed at all times and not dispensed as is a number of the liquid sources. A large variety of liquid sources pass through the Laboratory, unopened, to fill the requirements of users. Other liquid sources are obtained frequently in bulk quantities and these are dispensed regularly for distribution to the users. The radiopharmaceuticals dispensed regularly are iodine-131, technetium-99m, phosphorus-32, chromium-51, indium-113m and iron-59. In the production of technetium-99m, molybdenum-99 is used. (Refer also to comment in reply to question 10.3 below).

At all times the dispensing of these radiopharmaceuticals is carried out behind protective barriers. The air behind these barriers is continuously extracted (24 hours per day) even though the containers holding the materials are kept sealed, except at the time of dispensing. Monitoring of the air exhausted from the present dispensing area shows that, even without the use of filters, the concentrations of radioactivity are below the levels set down in the Victorian Regulations for these radioisotopes and also below the levels recommended by the International Commission on Radiological Protection (I.C.R.P.).

In the proposed Laboratory premises at Yallambie, the dispensing will be carried out in fume cupboards and the exhaust from these will be filtered with H.E.P.A. filters (99.97% efficiency hot D.C.P. test or equivalent). Activated carbon filters will be also included in addition to these H.E.P.A. filters to remove iodine-131 vapour from the air which is exhausted from the Laboratory. Any radioactivity that might be released to the atmosphere would therefore be only at a minute fraction of the maximum permissible concentrations in air set by either the Victorian Regulations or the Recommendations of the I.C.R.P.

It is proposed that continuous sampling of the exhausted air will take place along the duct leading to the point of discharge. The samples will be measured regularly at least once each week. Sampling will be by means of filter paper backed by activated carbon granules. The samples will be assayed by conventional means for β-and γ-emitting isotopes. All sampling and monitoring equipments used in the Laboratory are checked regularly to ensure that they are in satisfactory working condition and are correctly calibrated.

Filter banks will be monitored continuously to ensure that static pressure drop is maintained between upper and lower limits, this will ensure efficiency of operation. Alarms will register should filters approach either limit. Cut off controls will halt operation of the exhaust system before limits are reached.

With regard to the comparison of Victorian Regulations and Recommendations of the I.C.R.P. for maximum permissible concentrations, the following comments are made:-

(a) Hydrogen-3 and carbon-14 are not dispensed in the Sub-section and the figures quoted are therefore irrelevant. "Ra-222" is referred to and it is assumed that radon-222 is meant. Although the Laboratory operates a Radon Service at present, it is proposed that this Service shall not be continued at Yallambie. The service will be replaced by the use of other sealed radioactive sources, which are not gaseous and would not produce any release to air as would radon-222. The values for this isotope are therefore also irrelevant. It is therefore suggested that a comparison of the maximum permissible concentration for the isotopes listed in the Table below would be more appropriate.

TABLE

Maximum Permissible Concentrations in air of Representative Radioisotopes

Radioisotope	*I.C.R.P. Values Microcurie per cubic centremeter	**Vic. Reg. Values Microcurie per cubic centremeter	Ratio Col(3)/ Col (2)
Phosphorus-32	7×10^{-10}	1×10^{-7}	150
Iodine-131	1×10^{-10}	5×10^{-9}	50
Technetium-99m	3×10^{-7}	1×10^{-9}***	0.003
Chromium-51	1×10^{-7}	8×10^{-6}	80
Indium-113m	1×10^{-7}	1×10^{-9}***	0.01
Iron-59	2×10^{-9}	1.5×10^{-8}	8

* Recommendations of the International Commission on Radiological Protection. I.C.R.P. Publication 2. Report of Committee II on Permissible Dose for International Radiation. (Section II.4 and Table 1).

** Department of Health, Victorian Commission of Public Health, Health Act (1958): Regulations Relating to Irradiating Apparatus and Radioactive Substances. Victoria Government Gazette No. 56, 29/6/1959. (Amended 24/10/59 and 7/3/72.)

*** Levels for these isotopes are not listed separately in the Victorian Regulations and would therefore come under the heading "all other beta or gamma emitters".

(b) The Victorian Regulations do not indicate if the levels are based on concentrations for occupationally exposed persons or non-occupationally exposed persons. If they are for occupationally exposed persons, then the figures above should be divided by 30 to obtain a proper comparison with the I.C.R.P. levels which are for non-occupationally exposed persons. If the Victorian Regulations are for non-occupationally exposed persons, then the levels can be compared directly.

(c) The levels set by the I.C.R.P. are based on the doses which would be received by critical organs of non-occupationally exposed persons for continuous breathing of air containing the radioactive contaminants listed in its Recommendations. On the other hand, the Victorian Regulations specifically relate to the radioactive concentration at the point of discharge. The air at this point is not that normally breathed by the population. It would be diluted, even under adverse conditions, before being inahled by the population.

(d) The concentrations of radioactive contaminants at present exhausted from the Sub-section are below the levels given in the Table above for both I.C.R.P. and Victorian Regulations. With the use of filters in the exhaust system in the proposed Laboratory premises at Yallambie, the concentration would be only a minute fraction of any levels laid down by either the Regulations or the I.C.R.P. Recommendations. In other words no reliance is being placed on reduction of concentration levels due to atmospheric dilution.

(e) While there is at present a discrepancy between the concentrations recommended by I.C.R.P. and those currently prescribed in the Victorian Regulations, the statement in the Environmental Impact Statement commits the Laboratory to complying with the levels prescribed in the Victorian Regulations at any future time.

(f) The reason for referring to the Victorian Regulations in the Environmental Impact Statement is that they are the only legal levels laid down for Victoria and it is therefore appropriate that they be complied with.

Question 6.6 Could details of methods to be used for entrapping any gaseous radionuclide emissions, in particular radon-222 be given?

Comment: Radon-222 will not be used in the proposed premises at Yallambie and methods for entrapping iodine vapour have been covered in comments in reply to questions 6.3, 6.4 and 6.5.

7. Liquid Radioactive Wastes

Question 7.1 Could quantities, identities and half-lives be given for radioisotopes expected to be discharged into the M.M.B.W. sewer? What evaluation of effluent concentrations will be made?

Comment: The half-lives and maximum quantities of waste radioisotopes resulting from washing of glassware, hands, etc, which are expected to be discharged into holding tanks are as follows:-

Radionuclide	Half-Life	Maximum discharge per week
^{131}I	8 d	1 µCi
^{32}P	14 d	1 µCi
^{51}Cr	28 d	1 µCi
^{59}Fe	45 d	1 µCi
^{113m}In	1.7 h	10 µCi
^{99}Mo	2.8 d	10 µCi
^{99m}Tc	6 h	100 µCi

All liquid radioactive effluent will be stored in holding tanks above the ground within the building confines and will be monitored to ensure that its concentration meets the requirements of the Victorian Regulations before being discharged by pumping into the sewerage system. The concentration of radioactive substances used, will be very low, due to the copious amounts of water used to wash these substances into the holding tanks.

Two holding tanks normally will be used alternately. Whilst one tank is being used, the other will be monitored and then emptied by pumping to the Melbourne and Metropolitan Boards of Works sewerage system if the radioactive concentration is below prescribed levels. If the levels are not sufficiently low, the radioactive waste will be pumped through an ion exchanger into a third holding tank, where it will be further stored or diluted. Any spillage or leakage from a holding tank will be channelled by way of graded concrete floor to a sump, whence it will be pumped to a reserve holding tank and the defective tank is attended to.

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No liquid radioactive waste will be released to the Melbourne and Metropolitan Sewerage system until the concentration of radioactivity has been reduced to the prescribed levels or below.

Output wastes from radioactive laboratories will be reduced to below the permissible levels set by the Victorian Regulations by the following means:

All wastes, from laboratories in which radiopharmaceuticals will be used, will pass into neutralising tanks where they will be mixed with clean water and calcium carbonate ($Ca\ CO_3$) chips. The effluent from the radioactive laboratories will then pass into holding tanks where it will be detained and further diluted before reaching the sewer from the building.

All the effluents will be further diluted with domestic waste from the Laboratory prior to travelling at least 60 metres by way of a 225 millimetre pipe into the Melbourne and Metropolitan Board of Works sewer of 375 millimetre diameter.

Question 7.2 Could details be supplied for construction of holding tanks, provision of overflow sumps, and other precautions to be taken against accidental release of radioactive liquids into local watercourses?

Comment: Holding tanks are to be constructed of mild steel with an internal bitumen lining. They are above a graded concrete apron with a 150 millimetre clearance. The apron is at least 150 millimetres thick and its dimensions are 670 millimetres greater than the dimensions of the tanks. The apron rests upon a floor slab 150 millimetres thick and has a sump pump situated on it.

If a pipe outside the building cracks then the effluent which leaks out will be below the maximum permissible concentrations (see answer to 7.1 above) since measurements are made before discharge to these pipes. Further dilution will arise due to other non-radioactive discharges from the Laboratory. Any leaks would thus be highly diluted.

Question 7.3 What assessment has been made of the possibility of reconcentration of radioisotopes in stream biota, or in river muds, downstream from the Lower Plenty sewerage purification plant?

Comment: No assessment has been made of the reconcentration of radioisotopes in stream biota, or in river muds downstream from the Lower Plenty sewerage purification plant because of the considerations given above in the comments in reply to question 7.1.

8. Other Waste Disposals

Question 8.1 What are the identities and estimated daily quantities of chemical solvent fumes to be emitted to atmosphere?

Comment: The identities and estimated annual quantities of chemical solvents purchased for use in the Laboratory will be:

Methyl ethyl ketone	1 gallon
Chloroform	1 gallon
Ethanol	3 gallons
Methanol	4 gallons
Benzene	1 gallon
Acetone	5 gallons

Scrubbers will be installed to remove water soluble solvent vapours exhausted through fume cupboards.

Question 8.2 What quantities of non-water soluble solvents will be incinerated daily?

Question 8.3 What emission controls will be fitted to the proposed industrial incinerator?

Comment: Although it was proposed to incinerate some readily burnable material, mostly cardboard boxes, it has since been decided that this material shall be disposed of by means other than incineration and preferably by re-cycling. These questions are therefore not relevant.

Question 8.4 Could quantities, nature and methods of disposal be provided for radioactive solid wastes.

There is a range of materials collected for disposal and it is not practical to list the quantities and their nature. Basically the materials are divided into two groups, according to the half-lives of radionuclides present. The materials will be stored on the premises under controlled conditions until the arrangements for their disposal can be made. All materials are place in suitable bags or steel drums for disposal.

Materials contaminated with short half-life radionuclides are stored until such time as their radioactive content has decayed to extremely low levels. They are then buried in their bags under the supervision of a Physicist at a site remote from Yallambie. This disposal is carried out with the approval of the State Department of Health and of the Officers of the City in which the disposal takes place. The State Department of Health is always informed of the details relating to the disposal.

Long half-life radionuclides are periodically transferred, in suitable transport containers, to a special storage area owned by the Australian Government; The area is far removed from Yallambie.

9. Transport of Radioactive Substances

Question 9.1 Could estimates be given for the number of daily movements of radioactive materials into and from the proposed A.R.L. premises:

(i) upon completion
(ii) by 1980.

Comment: The estimated number of daily movements of radioactive materials into and from the proposed Laboratory premises are:

Vehicles into the proposed premises	3 per day
Vehicles out from the proposed premises	9 per day
Total	12 per day

It is not anticipated the number of schedule vehicular deliveries of radioactive materials to and from the Laboratory will alter between completion of the premises and 1980.

Question 9.2 Could the relative percentage of movements of radioactive materials along the major traffic outlets from the proposed site be estimated?

Comment: Of the 12 vehicular movements daily it is anticipated that movements will be predominately west along Lower Plenty Road to Greensborough Road, Rosanna Road or Lower Heidelberg Road, and a smaller number east along Lower Plenty Road to Templestowe Road and Fitzsimons Lane.

APPENDIX 2

10. Future Expansion

Could an estimate be given for the following over the next 10 years:

Question 10.1 What additional functions could be carried out at the proposed premises at Yallambie?

Comment: The functions of the Laboratory are those establsihed under the Commonwealth Radiation Laboratory Order' made under Section 9 of the National Health 1953-1971. There is no known reason why these functions should be changed and no change is envisaged.

Question 10.2 What extensions to the proposed buildings are envisaged?

Comment: Provision has been made for possible future expansion of the building should the need arise but the proposed premises will provide ample accommodation to at least 1980.

Question 10.3 What quantities of radiopharmaceutical materials are anticipated to pass through A.R.L. premises, by 1985?

Comment: Examination of the Annual Reports of the Laboratory over the past twenty years shows that the use of radiopharmaceuticals in Australia has been continually increasing over that time and particularly over the last ten years. No doubt it will continue to increase for a few years but it is impossible to say how long the increase will continue or to predict the rate of increase. These radiopharmaceuticals are used throughout Australia by Medical Institutions.

The recent increase in the in vivo use of radiopharmaceuticals has been largely due to the development of technetium-99m labelled materials. Technetium 99-m has a 6 hour half-life and decays with the emission of 140 kV gamma rays which are more easily absorbed than the gamma rays from iodine-131, gold-198, iron-59, chromium-51 etc. Future developments could involve the use of radioisotopes with shorter half-lives and more satisfactory decay characteristics than technetium-99m. It is quite possible that some of the present techniques may be replaced by procedures which do not involve the administration of radiopharmaceuticalsto the patient e.g. ultrasound scanning, X-ray fluorescence scanning and EMI X-ray computer scanning.

All radiopharmaceuticals currently dispensed in the Laboratory are in liquid form. Most others that are obtained from overseas suppliers and then distributed from the Laboratory are also in liquid form. A few are obtained in freeze-dried form or as capsules. The freeze dried materials are obtained from overseas and then supplied to users as single dose ampoules which are re-constituted to solution form by the user before administration to patients. The capsules are distributed from the Laboratory to users for administration to patients. There is no dispensing of these materials at the Laboratory. One development that is being pursued vigorously is the preparation of non-radioactive freeze dried reagents which are re-constituted by the user, generally with ^{99m}Tc solution, before use. Preparation of the reagents does not involve the use by the Australian Radiation Laboratory of radioactive material.

Because of likely variations in supply and demand it is impossible to estimate the quantities and types of radioactive substances that are likely be distributed by the Laboratory in the next 10 years and beyond.

Question 10.4 What other Australian Government activities are planned to be located in land adjoining or near to the proposed site at Yallambie?

Comment: This is a matter of Government policy and as it goes beyond the responsibility of the Australian Department of Health, the Laboratory is not in a position to comment on this question.

APPENDIX 3

AUSTRALIAN RADIATION LABORATORY: PROPOSED WATSONIA SITE

ASSESSMENT OF POTENTIAL RADIATION RISKS TO YALLAMBIE DISTRICT RESIDENTS

The report attached herewith has been prepared by F.P.J. Robotham, M. Inst. P., A.A.I.P.; Radiation Protection Officer, University of Melbourne.

The writer has worked in the field of Radiation Protection for 17 years, including 9 years as an Operational Health Physicist at the Atomic Energy Research Establishment Harwell, England. Two years were spent working in Health and Safety Division at the Australian Atomic Energy Commission Research Establishment, Lucas Heights, the last 6 years as Radiation Protection Officer, Melbourne University.

In addition the writer is a member of the ad-hoc Sub-Committee on the Safe Disposal of Radioactive Wastes, established by the National Health and Medical Research Council, and Secretary of the currently forming Australian Radiation Protection Association.

APPENDIX 3

AUSTRALIAN RADIATION LABORATORY: PROPOSED WATSONIA SITE

ASSESSMENT OF POTENTIAL RADIATION RISKS TO YALLAMBIE DISTRICT RESIDENTS

1. INTRODUCTION

1.1 This report reviews the ionising radiation hazards to which residents of the Yallambie area may be exposed if the Australian Radiation Laboratory (ARL) is built on the proposed site at Lower Plenty Road, Watsonia, Victoria.

1.2 Throughout the report references will be made to the Environmental Impact Statement prepared by the Australian Department of Health dated August 1973 (1) (hereinafter referred to as the EIS), and to an unsigned, undated document entitled "Comments on Information requested by Mr. J.A. O'Connor, ... Questions Pertaining to the Proposed Site for the Australian Radiation Laboratory at Yallambie, Victoria" (2) (referred to hereinafter as ARLC, to avoid confusion with references to the Australian Radiation Laboratory itself which will be abbreviated to ARL). Other references are listed at the end of this report.

2. POTENTIAL RADIATION HAZARDS

2.1 Residents of the Yallambie district could be exposed to an ionising radiation hazard from one or more of the following sources:

a) use of irradiating apparatus (X-ray units, sealed gamma ray sources) giving rise to radiation beams outside the laboratory walls,

b) release of radioactive material to the environment during:

i) normal work

ii) waste disposal operations

iii) accident conditions.

2.2 The external radiation hazard is usually controlled by using the irradiating apparatus in a shielded area, monitoring the radiation levels and ensuring that people cannot be exposed to

radiation levels above the prescribed limits.

2.3 The problem with unsealed radioactive materials is to prevent them getting into people. This can occur via 3 main routes. Radioactive particles or gases can be breathed in directly, radioactive materials can be absorbed in water and subsequently drunk, or they can be incorporated in foodstuffs and thereby eaten. Control procedures must guard all three routes.

3. EXTERNAL RADIATION HAZARD ARISING FROM THE USE OF X-RAY UNITS AND SEALED RADIATION SOURCES (REFERENCE EIS 6.3.4. and ARLC 3.)

3.1 In both EIS and ARLC it is stated that the design of the laboratory, associated shielding and control procedures to be adopted whilst using irradiating apparatus will be such that the dose rate at the site boundary will not exceed 5 millirem/year. This is 1% of the National Health and Medical Research Council's (NHMRC) recommended level of 500 millirem/year for non-occupationally exposed personnel (3). This figure was derived from the recommendations of the International Commission on Radiological Protection (ICRP) (4).

3.2 Doubt has been cast on the validity of the ICRP figures by, amongst others, Drs. Gofman and Tamplin (5) who have suggested that the levels have been set too high. However, by adopting a figure of 1% of the ICRP recommendation ARL are being conservative even by Gofman and Tamplin's standards.

3.3 Recent reports (6,7) have made quantitative estimates of radiation risks at low levels of exposure assuming that the response is proportional to dose and that there is no threshold below which lower levels of radiation have no effect. The BEIR report (6) suggests that there will be 200 deaths each year due to cancer for a population exposure of 10^6 man-rem. Assuming that in the Yallambie district 1,000 people will be exposed to external radiation at the rate of 5 millirem/year, the population exposure will be: $1{,}000 \times 5 \times 10^{-3}$ man-rem/year = 5 man-rem/yr.

So the number of additional cancer deaths per year will be

$$\frac{200 \times 5}{10^6} = 10^{-3}/\text{year}$$

or one every 1,000 years.

3.4 An estimate of the genetic risk can be derived from figures quoted by the Australian Academy of Science in their 1973 report on the Biological Effects of Nuclear Explosion Fallout (8). A level of 1 millirem/year to each member of the Australian population (10^7 people) would correspond to one mutation every 10 years leading to death or disability in the first generation. The total genetic damage to future generations would be larger than this because it will include mutations which do not become obvious in the first generation. A uniform dose of 1 millirem to the Australian population could give rise to a total of between 50 and 100 genetic deaths and disabilities over all subsequent generations. Thus for a population of 1,000 persons exposed to 5 millirem/year there would be a genetic burden of less than one additional mutation (genetic death) every 10 generations.

3.5 The risk estimates derived above must be treated with some caution as they are based on very doubtful extrapolations of data. Because the possible effects, expressed quantitatively, are so low as to be almost meaningless, it may be more appropriate to compare the possible radiation dose i.e. 5 millirem/year with the average annual natural background radiation of 100 millirem/year, received by all members of the population. However the derived figures do represent upper estimates of risk and indicate the extremely low hazard arising from the use of irradiating apparatus at the proposed laboratory.

3.6 In ARLC, answer to question 3.1 the statement is made "monitoring will be carried out at points inside and in close proximity to the outside of the building. From these measurements it will be possible to calculate the levels at the boundaries...". Where collimated beams of radiation are being used inverse square law calculations are not applicable nor is air attenuation likely to be significant and it would be more appropriate to make some attempt to measure the radiation levels.

3.7 Recommendation One.

If the building is erected at the proposed site, when monitoring checks are being made of the effectiveness of the concrete shielding some type of integrating dosimeter should be installed at several carefully selected points around the boundary fence. These could be left for a period of say 1 to 3 months to see if there is any radiation above the natural background level. The results from these dosimeters should be submitted to the Environmental Protection Authority (EPA) or the Victorian Health Department (VHD) who could then notify a representative of the Yallambie residents to reassure them that the radiation levels do not exceed those quoted in the EIS.

3.8 Conclusion

If the dose rates are kept below the levels suggested by ARL there will not be an external radiation risk to people living in the locality.

4. RELEASE OF RADIOACTIVE MATERIAL TO THE ENVIRONMENT UNDER NORMAL WORKING CONDITIONS (REFERENCE EIS 6.3.9 and ARLC 6)

4.1 The potential hazard arises from the possible discharge of particulate radioactive materials and radioactive gases from the dispensing laboratories. However the ARL state that they will be installing extract filters with a high collection efficiency for respirable size particles coupled with activated charcoal filters to remove radioactive iodine vapour. These should effectively prevent release of radioactive materials into the environment.

4.2 The recommendations made by ICRP (9) for the various maximum permissible concentrations in air [(mpc)air] for non-occupationally exposed personnel are in most cases more restrictive than the recommendations made by the Victorian Health Department (10), as shown in the following table.

APPENDIX 3

TABLE I

Maximum Permissible Concentrations in air of Representative Radionuclides

Radionuclide	ICRP Value Microcurie per cc (μCi/cc)	Victorian Regulations Value Microcurie per cc (μCi/cc)
Phosphorous 32	7×10^{-10}	1×10^{-7}
Iodine 131	1×10^{-10}	5×10^{-9}
Technicium 99m	3×10^{-7}	1×10^{-9}
Chromium 51	1×10^{-7}	8×10^{-6}
Indium 113m	1×10^{-7}	1×10^{-9}
Iron 59	2×10^{-9}	1.5×10^{-8}

The Victorian figures are based on levels at a discharge point whilst the ICRP figures are based on a continuous breathing level leading to a maximum permissible intake of a particular radionuclide.

4.3 Data published by Bryant (11) suggests that under adverse weather conditions (atmospheric inversion) with little or no thermal lift and no elevated exhaust, atmospheric dilution could be less than a factor of 100 at the site boundary. Therefore it would be appropriate to adopt the more restrictive ICRP values when monitoring the exhaust effluent. (NOTE The figures quoted for Technicium 99m and Indium 113m are lower in the Victorian Regulations only because those radionuclides were not considered when the Regulations were issued over 15 years ago, they thus come under the heading of "all other beta and gamma emitters". The ICRP figures are therefore the more valid levels.) Use of the ICRP figures would mean that the local residents are unlikely to be exposed to more than 1% of the recommended (mpc) air for non-occupationally exposed personnel - a level comparable to the external radiation level proposed by ARL.

4.4 The risk estimates discussed in sections 3.4, 3.5 and 3.6 are applicable to internal irradiation and if ARL adopt the ICRP figures and keep environmental releases to those levels the comments made in section 3.6 are applicable.

4.5.1 Recommendation Two

That the ICRP levels of (mpc) air for non-occupationally exposed personnel be adopted as the upper limit for release of radioactive exhausts.

4.5.2 Recommendation Three

That the monitoring results from the exhaust sampler be submitted to either the EPA or the VHD on either a quarterly or annual basis so that these bodies can ensure that no untoward quantities of radioactive materials are being released to the environment and can advise the Yallambie residents accordingly.

4.6 Conclusion

Under normal working conditions there should be no significant risk to people living near the proposed laboratory from the release of radioactive materials.

5. RELEASE OF RADIOACTIVE MATERIAL TO THE ENVIRONMENT DURING WASTE DISPOSAL OPERATIONS (REFERENCE EIS 7 and ARLC 7; 8.4)

5.1 Solid Waste

Both low level and high level solid radioactive wastes are to be disposed of at a site remote from Yallambie and do not present a hazard to local residents.

5.2 Gaseous Waste

The disposal of gaseous and particulate wastes was effectively discussed in section 4 of this report.

5.3 Liquid Wastes

Discharge of radioactive materials are of especial concern if the discharged material can enter water courses and be concentrated in stream biota, river mud etc. Most of the radionuclides that ARL propose to discharge are of such short half life that by the time any concentration in fish and subsequent human consumption could take place the radioactivity would have decayed to negligible levels.

5.3.1 The longer lived isotopes listed in Table II are of interest however.

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TABLE II

Longer Lived Radionuclides likely to be dischaged by ARL

Radionuclide	Half Life	ARL Max.Discharge per week microcurie	ICRP(mpc)water* microcurie/cc	Vic.Regs. microcurie per cc
I^{131}	8d	1	2×10^{-6}	3×10^{-5}
P^{32}	14d	1	2×10^{-5}	2×10^{-4}
Cr^{51}	28d	1	2×10^{-3}	0.5
Fe^{59}	45d	1	6×10^{-5}	1×10^{-4}

* Maximum permissible concentration in water for continuous exposure of non-occupationally exposed persons (9).

Adapting methods used elsewhere (12,13) for determining discharge limits for Nuclear Power stations the following estimates can be made of possible radiation exposure from the discharge of the longest half lived radionuclide Iron 59.

5.3.2 The discharge rate from the Lower Plenty sewerage treatment plant is approximately 5×10^9 cc/day ($\equiv 10^6$ gallons per day). The proposed discharge of Fe 59 from ARL is 0.2 microcurie per day. Assuming uniform mixing at the Lower Plenty discharge point this would lead to an average concentration of $\frac{0.2}{5 \times 10^9} = 4 \times 10^{-11}$ microcurie/cc.

Assuming that Red Fin fish concentrate Fe 59 by a factor of 10^5 (no data is available on the reconcentration factor and a pessimistic upper figure has been assumed i.e. the reconcentration of Zinc 65 in Oyster flesh), and that an enthusiastic fisherman ate 200 g. of Red Fin per day, the average daily intake of Iron 59 would be $4 \times 10^{-11} \times 10^5 \times 2 \times 10^2 = 8 \times 10^{-4}$ microcuries/day.

5.3.3 The ICRP recommended (mpc)water for members of the public is 6×10^{-5} microcuries/cc. The daily drinking water consumption of the ICRP "standard man" is 2.2 litres/day, thus the maximum

permissible intake of Iron 59 is $6 \times 10^{-5} \times 2.2 \times 10^{3} = 1.3 \times 10^{-1}$ microcuries/day (i.e. approximately 10^{-1} μCi/day)
c.f. estimated maximum daily intake of
8×10^{-4} microcuries/day (i.e. approximately 10^{-3} μCi/day)
thus the maximum intake of radioactive Iron through eating contaminated fish is unlikely to exceed 1% of the ICRP recommended maximum permissible figure.

5.3.4 It must be emphasised that the figure of 8×10^{-4} microcuries/day has been derived using extremely doubtful assumptions regarding concentration factors and possible fish consumption. The figure however gives an upper estimate of possible Fe 59 ingestion and without data on concentration factors etc. it is doubtful if a more accurate estimate can be made.

5.3.5 A fracture in either a pipe or holding tank is unlikely to lead to any significant release of radioactive material to the environment. The tanks will be situated on a graded concrete apron complete with sump pump to control any leakages. Any radio-active liquid escaping from a leaking pipe will already be below the appropriate (mpc)water and reconcentration is unlikely in the stream running along the site boundary fence.

5.3.6 Recommendation Four

The ICRP recommendations for (mpc)water which are more restrictive than the levels given in the Victorian Regulations (see Table II), should be adopted as the upper limits for the discharge of radioactive liquids.

5.3.7 Recommendation Five

Results of pre-discharge effluent sampling should be submitted periodically to the EPA or the VHD.

5.3.8 Recommendation Six

If the laboratory is built at the proposed site and either longer half life, more toxic or greater quantities of radionuclides are likely to be discharged, assessments of reconcentration factors in the Lower Plenty River should be made to determine critical exposure groups, exposure pathways, and critical radionuclides.

5.3.9 Conclusion

Provided the proposed discharge levels quoted in ARLC (Table II this report) are not exceeded, there should not be a significant hazard to local residents or other groups of people likely to be exposed to the effluent either directly or indirectly.

6. RELEASE OF RADIOACTIVE MATERIALS TO THE ENVIRONMENT UNDER ACCIDENT CONDITIONS

6.1 Three types of emergencies must be considered:

a) an accident involving a vehicle carrying radioactive materials

b) a major spillage of radioactive material within the laboratory

c) a fire involving radioactive materials.

These possibilities are considered in some detail below.

6.2 An Accident involving a Vehicle Carrying Radioactive Materials (Reference EIS 8, ARLC 9)

6.2.1 In EIS 8 it is stated that materials will be transported in a manner that complies with the Victorian Radioactive Substances Regulations (10) and the International Atomic Energy Code of Practice (14). This latter Code states that materials must be carried in carefully designed fire-proof, impact-proof containers such that a release of radioactive material is extremely unlikely following even a severe motor vehicle accident.

6.2.2 Conclusion

The transport of radioactive materials presents a negligible risk to both Yallambie residents and other road users.

6.3 Spillage of Radioactive Material within the Laboratory leading to release of Radioactivity outside the Building (Ref. ARLC 6.2)

6.3.1 By using standard control procedures (15) the probability of any significant levels of radioactive material being transferred outside the building is extremely small.

6.3.2 Conclusion

The procedures outlined in reply to question 6.2 ARLC are

more than adequate to prevent the release of radioactive substances to the immediate environment.

6.4 A Fire in the Laboratory involving Radioactive Materials (Reference ARLC 6.2)

6.4.1 Very little information is available in the literature on the frequency or extent of fires in radioisotope laboratories that have given rise to the release of radioactive materials. A sprinkler system that dampens a fire before it reaches major proportions must substantially reduce the possibility of the vapourisation and dispersion of radioactive substances. Although not stated in ARLC it is assumed that the sprinkler will be activated automatically be either smoke or temperature rise.

6.4.1.1 In an attempt to assess the maximum credible accident and its impact on the surrounding area the following (pessimistic) assumptions have been made.

A major fire occurs in the Laboratory releasing one millicurie (1,000 microcuries) of Iodine 131 (the most volatile and toxic radionuclide in regular use in an unsealed form). The release occurs over a period of one hour during adverse meteorological conditions (atmospheric inversion).

6.4.1.2 Exhaust gases, smoke, steam etc. would be equivalent to at least 10^3 cubic meters of air i.e. 10^9cc, giving an effective release concentration of 10^{-3} microcuries/cc. Atmospheric dilution should further reduce this to 10^{-6} microcuries/cc at the nearest house. Now the (mpc)air of Iodine 131 is 10^{-10} microcuries/cc for non-occupationally exposed persons. Thus a resident could be exposed to about 10,000 times the permissible continuous (mpc)air for say 1 hour. There are approximately 9,000 hours in a year so a major fire could give rise to about 1 year's permissible exposure to radioactive Iodine.

6.4.1.3 Radioactive Iodine inhaled or ingested concentrates in the Thyroid gland where it can lead to cancer of that organ. Published data (7) indicate that there could be about 4 Thyroid cancer cases in one million people irradiated by 1 rem from Iodine 131 in the Thyroid. One year's permissible intake of Iodine 131 is equivalent to a dose commitment of about 3 rem, thus

leading to about 10 cases of Thyroid cancer per 10^6 persons irradiated i.e. 0.01 cases in a Yallambie population of 1,000. This figure like others derived in sections 3.3 and 3.4 is so small as to the almost meaningless.

6.4.1.4 It must be emphasised most strongly that the above calculation is based on some extremely pessimistic assumptions, and it represents a most unlikely eventuality. It does however give some indication of the possible affect on the district, of a large fire in the laboratory.

6.4.2 Recommendation Seven

That the installed sprinkler system be of an automatically activated type, and the sprinkler run-off should be directed to the holding tanks use for liquid radioactive wastes.

6.4.3 Conclusion

A major fire could lead to residents in the Yallambie area being exposed to some low levels of airborne radioactive contamination, particularly Iodine. Insufficient information is available to assess the true probability of such a fire and the subsequent quantities of radioactive materials likely to be released to the atmosphere. The installation of a sprinkler system in the laboratory reduces the possibility of any fire reaching major proportions, the fire hazard thus represents an extremely small risk to the residents of the Yallambie district.

7. SUMMARY OF RECOMMENDATIONS

7.1 With two exceptions (6 and 7 q.v.) the recommendations made are;

a) where there are differences between ICRP and the Victorian Regulations in recommended maximum permissible levels the more recent ICRP figures should be adopted as the criteria for determining permissible releases of radioactive substances;

b) where monitoring is being carried out to determine radiation and surface and air contamination levels the results of such monitoring should be submitted to a competent Authority. Thus ensuring that ARL would not be placed in the difficult

position of being both the operating and regulatory body and would be seen to be complying with its own recommendations and Codes of Practice.

7.2 If implemented, none of the recommendations should detract from the efficient operation of the laboratory.

8. CONCLUSIONS

8.1 Normal laboratory operating procedures should not give rise to any significant radiation hazard to residents of the Yallambie district.

8.2 A major fire releasing radioactive material could possibly lead to a slight radiation dose being received by people living near the laboratory. The fire risk is an extremely small one however, no realistic estimate of the probability of such a fire nor its effect on the district can be made with any degree of accuracy.

8.3 The siting of the Australian Radiation Laboratory at the proposed location in Watsonia could lead to an extremely small radiation exposure to the residents of the area. Although of no biological significance this slight hazard could be removed by relocating the laboratory in a less densely populated area.

Melbourne,
Victoria.
August, 1974.

F.P.J. Robotham
M. Inst. P., A.A.I.P.

APPENDIX 3

REFERENCES

1) Australian Department of Health - Environmental Impact Statement, Proposed premises for the Australian Radiation Laboratory at Lower Plenty Road, Watsonia, Victoria, August, 1973.

2) Australian Radiation Laboratory - Comments on Information Requested by Mr. J.A. O'Connor ... Questions Pertaining to the Proposed Site for the Australian Radiation Laboratory at Yallambie, Victoria.

3) National Health and Medical Research Council - Revised Radiation Protection Standards for Individuals exposed to Ionising Radiations, Canberra, October 1967.

4) International Commission on Radiological Protection - Publication 6 Recommendations of ICRP (as Amended 1959 and revised 1962)

5) Gofman, J.W. and Tamplin A.P. - Population control through Nuclear Pollution, Chatto and Windus, 1971.

6) National Research Council, National Academy of Science - Effects in Populations of exposure to Low Levels of Ionising Radiation; Report of the Advisory Committee on the Biological Effects of Ionising Radiation, Washington D.C. November, 1972.

7) United Nations - Ionising Radiations: Levels and Effects, A report of the United Nations Scientific Committee on the Effects of Atomic Radiation to the General Assembly, with annexes, New York 1972.

8) Australian Academy of Science: The Biological Effects of Nuclear Explosion Fallout, Report to the Prime Minister, April 1973.

9) International Commission on Radiological Protection - Report of Committee II on Permissible Doses for Internal Radiation (1959) (and amendments and additions).

10) Victorian Government Gazette: Regulations Relating to Irradiating Apparatus and Radioactive Substances. Department of Health, Victoria June 1959.

11) Bryant P.M. - Methods of Estimation of the Dispersion of Windborne Material and Data to assist in their application. UKAEA AHSB(RP) R42 1964.

12) International Atomic Energy Agency - Safety Series No. 12 The Management of Radioactive Wastes produced by Isotope Users, Vienna, 1965.

13) International Atomic Energy Agency - Safety Series No. 36, Disposal of Radioactive Wastes into Rivers, Lakes and Estuaries, Vienna 1971.

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14) International Atomic Energy Agency - Safety Series No. 6, Regulations for the Safe Transport of Radioactive Materials, Vienna 1961.

15) International Atomic Energy Agency - Safety Series No. 1, Safe Handling of Radionuclides, Vienna 1973.

APPENDIX 4

PLANNING ISSUES

Jeffrey A. Porter B.T.R.P.(Melb.), M.I.E.(Aust.), C.E., E.W.S., Dip.C.E., M.B.S., A.A.I.B.S.

1. GENERAL

Although it is probable that the Australian Government is not legally bound to comply with planning controls, it would appear reasonable that the Government should, before constructing a development in an area which is subject to planning controls, consider the general planning issues involved, and the effects on adjacent land use. Such considerations could ensure that "uncontrollable" developments are consistent with the adjacent land users' expectations for the future development of their area, as implied by an existing planning scheme.

The present Government has an outstanding record in initiating planning objectives. The submission of this report is direct evidence of the Government's willingness to consider the planning issues involved in normal Government activities.

2. ZONING

The present zoning of the proposed A.R.L. Scheme is "Public purposes - Commonwealth Government" (see zoning map attached).

Referring to land reserved for public purposes, the ordinance[2] states: "where a purpose is described by reference to the Commonwealth Government it shall be deemed to mean and include the exercise of any of the powers of such governments".

However, as stated earler, it would be desirable to consider what the use of the land should be to ensure proper and orderly development of the area, if the overall planning scheme was not inhibited by lack of control over the Federal Government's activities.

The whole of the Watsonia Military Camp is surrounded by residential development. The Heidelberg City Council have pre-empted future residential development of the area by insisting that roads be provided in adjacent subdivisions at Yallambie (see map no. 53 M.M.B.W. Scheme)[2], and the possibility of residential development at Watsonia was suggested in Australian Government policy speeches. For these reasons, it seems logical that the area should be used for residential development or for uses associated with residential development (open space, schools, local shopping, etc.).

The proposed A.R.L. development closely resembles a first industrial/commercial intrusion into an area which is predominantly residential in character.

3. VISUAL INTRUSION

The proposed development is not residential in character because:

1. The scale of development is too large (occupying approx. 3 hectares[3])
2. The proposed buildings and car parks are of a type of construction which does not blend with the existing residential development (see architects' sketches).
3. The materials of construction (concrete and exposed aggregate) are normally associated with commercial buildings.
4. The 3-storey east wing[4] can be readily seen from adjacent residential developments. The topography of the adjacent area makes landscape screening very difficult, and it is doubtful whether a critical analysis as to the effectiveness of the proposed landscaping has been carried out.

   In the future, if the building area is doubled[5] and the east wing is extended northwards, the detrimental visual aspects will be increased.

4. TRAFFIC CONSIDERATIONS

The proposed site has very few transportation advantages over other areas within the Metropolitan Region. At present there are no special road transport facilities, and public transport services are poor.

The same argument can be applied for future transportation. The proposed site has no great advantage over many other areas. With the future of freeways at present undecided, it is premature to make predictions regarding their future construction.

At the site itself, further local problems may arise. Lower Plenty road traffic volumes are approaching saturation flows at peak hours (1200-1300 cars/lane/hour[6]), and the movement of an additional 68-90 cars will cause further congestion. When the proposed A.R.L. development doubles in the future, the problem will be further aggravated.

5. DRAINAGE

Although the land falls 1:10 to a creek, and "this will ensure good drainage of the site at all times"[7], no consideration has been given to the effect, on adjacent residential areas, of the increased volume of water in the nearby creek. The run-off from the proposed A.R.L. development will be at least 3 to 4 times as great as at present, and the ramifications of this should be fully explored. Flooding of homes built along the course of the creek has already occurred.

6. CONCLUSION

In making its decision to locate at Yallambie, the Australian Department of Health has failed to consider the proper and orderly development of the area as a whole. A rational decision must consider the total ("real") cost to the whole community - not only the cost to the Department of Health. External costs of possible pollution and risks (discussed in detail in other sections of this submission), visual intrusion, drainage, services and possible traffic congestion must be considered in the overall evaluation. Opportunities for alternative uses, to be lost if the proposed utilisation proceeds, should also be considered. Before other sites are dismissed because the "cost of commercial land in these areas is expensive",[8] an economic comparison must be made between the "real" cost at alternative sites within areas zoned for uses similar to those proposed by the Australian Department of Health.

It would appear that existing industrial zones in the vicinity of Tullamarine Airport and freeway would provide more suitable sites for the proposed development.

REFERENCES

1. M.M.B.W. : Melbourne Metropolitan Planning Scheme, Map No. 53.

2. M.M.B.W. : Melbourne Metropolitan Planning Scheme Ordinance, p.75.

3. Australian Department of Health : Statement of Evidence to be submitted to the Parliamentary Standing Committee on Public Works. p.2.

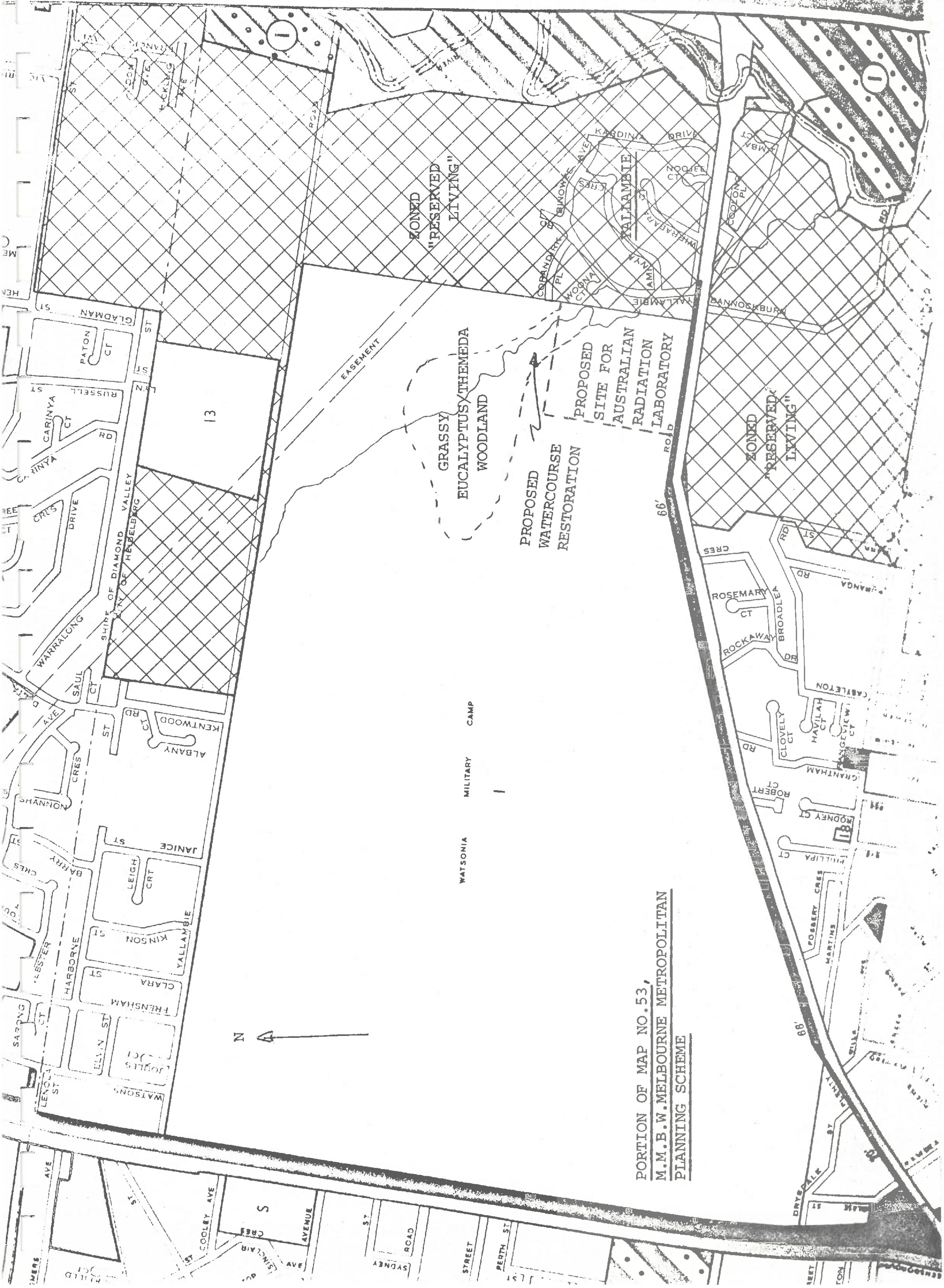
4. OP CIT Australian Department of Health p.9

5. IBID. p.6.

6. C.R.B. Traffic Counts 21 March, 1973

7. Australian Department of Health : Environmental Impact Statement, p.22

8. IBID p.18.

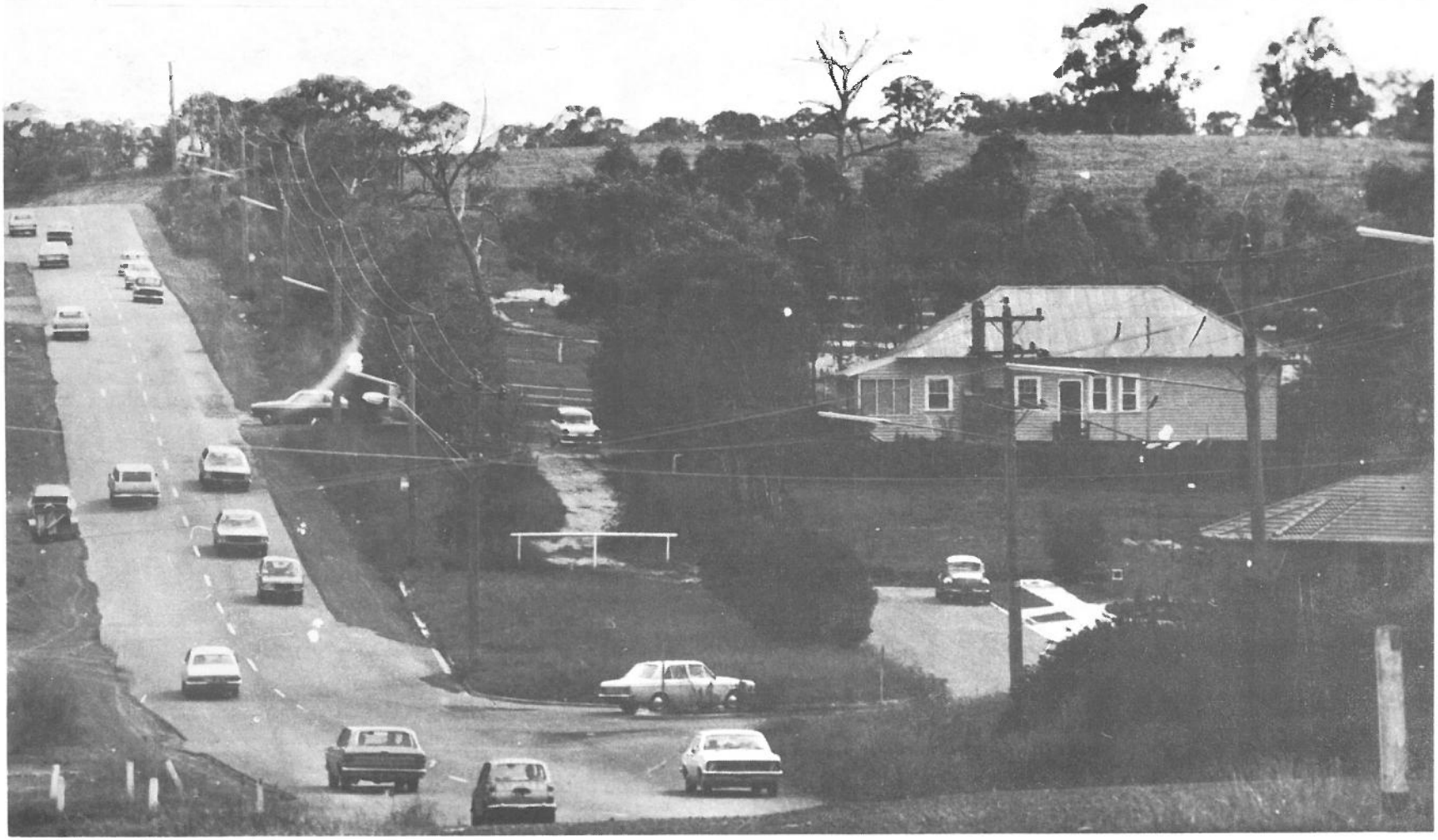

ZONED "RESERVED LIVING"
GRASSY EUCALYPTUS/THEMEDA WOODLAND
PROPOSED WATERCOURSE RESTORATION
PROPOSED SITE FOR AUSTRALIAN RADIATION LABORATORY
EASEMENT
WATSONIA MILITARY CAMP
YALLAMBIE
ZONED "RESERVED LIVING"
N
PORTION OF MAP NO.53,
M.M.B.W. MELBOURNE METROPOLITAN
PLANNING SCHEME

APPENDIX 4

Proposed A.R.L. Site -
View across flooded creek
from Yallambie.

APPENDIX 4

Lower Plenty Road
and Proposed A.R.L. Site.



APPENDIX 5

GRAY & JOHNSON

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STATEMENT OF OPINION RE VALUATION IMPACT

PROPOSED PREMISES FOR AUSTRALIAN RADIATION LABORATORY

LOWER PLENTY ROAD, YALLAMBIE, VICTORIA

BY

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Bachelor of Commerce

Diploma of Agriculture

Fellow of Real Estate Institute

Associate Commonwealth Institute of Valuers

Partner in Firm of Gray & Johnson

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Qualified Valuer No. 893

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TELEPHONE: 654 3022

June 20, 1974.

Mr. John O'Connor,
Centre for Enviromental Studies,
Preston Institute of Technology,
Plenty Road,
BUNDOORA. 3083

Dear Sir,

STATEMENT OF OPINION RE VALUATION IMPACT

PROPOSED PREMISES FOR AUSTRALIAN RADIATION LABORATORY

LOWER PLENTY ROAD, YALLAMBIE, VICTORIA

Pursuant to your instructions of June 13, 1974 to provide a statement of opinion to evaluate the valuation impact of the proposed premises for the Australian Radiation Laboratory situate Lower Plenty Road, Yallambie, Victoria on surrounding residential areas, I have personally inspected the site and the surrounding areas, ariel photographs, plans, and elevation drawings of the proposed premises and report as follows :-

PROPOSED USE

I understand that various activities will be carried out in the proposed premises including procures, processes and issues of quantities of radioactive

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materials under conditions carefully designed to minimise escape of these substances into the enviroment.

SITE

The site for the proposed premises is approximately 7 acres (approx. 3 Hectares) in the South-East corner of land now occupied by the Watsonia Army Barracks and the particular land is now used for grazing and the conduct of a horse riding school. The site has a frontage to Lower Plenty Road and is approximately 10 miles (16 Kilometres) in a direct line and approximately 14 (22.5 Kilometres) by major roads from the centre of Melbourne.

LOCATION

To the East and South of the proposed site there is extensive, solid, attractive residential development areas consisting of brick veneer houses constructed within the last decade. The area is now almost fully developed, is well planned and laid out with attractive street architecture and is well provided for by community and other services.

PROPOSED BUILDING

From an inspection of the plans and elevations the proposed building will be a laboratory of a semi-light industrial nature similar to other Government

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and private enterprise Research and Development centres.

It will be a two storey, airconditioned building having an area of 84,500 square feet (7,850 square metres) and the surrounding land will consist of landscape gardening and car parking for 60 cars plus areas for future extensions and future car parking.

OPINION

1. It is my opinion that the value of surrounding property shall be detrimentally effected if the proposed Australian Radiation Laboratory is erected on the proposed site. The property values will be detrimentally effected for two reasons :-

   (a) A building as outlined in the proposal and being of a semi-industrial research and development nature will detract from the visual appeal of the area and will cause higher traffic densities in the adjoining areas in comparison with the present land useage and therefore, the surrounding properties will loose some buyer appeal.

   (b) The building will be known as the Australian Radiation Laboratory and there will be some public knowledge of the type of work being carried out in the building which, whether this knowledge is accurate

.../4

or inaccurate, will detract from the desireability of the area and cause a diminishing of buyer appeal.

2. It is my belief that the detrimental effect of the proposal will not be in absolute terms in that the value of the surrounding homes will not actually decrease, however, because of the building and the nature of the work being carried out, I am of the opinion that the surrounding properties will not increase in value to the same extent as they would in the future if the present use was maintained on the site and furthermore, any increase in value will be not as great as comparable residential property in other locations.

3. The greatest detrimental effect to the value of surrounding property will be within a radius of ¼ mile (400 metres) from the proposed Australian Radiation Laboratory and the detrimental effect on value will progressively diminish to nil on properties situate more than ½ mile (800 metres) from the proposed Laboratory.

4. I have been requested to comment on the impact on valuations if the site for the proposed Laboratory were to be on the wooded hill top behind the existing proposed site or on another site somewhere within

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APPENDIX 5

Mr. John O'Connor June 20, 1974

the Watsonia Army Barracks land and I am of the opinion that any detrimental effect would decrease proportionately to the distance from any residential area.

Yours faithfully,

MALCOLM GRAY, B.Comm., D.D.A., F.R.E.I., A.C.I.V.

MAG:CF

APPENDIX 6

ECOLOGICAL REPORT

On June 25 and June 28 1974, I visited the site of the proposed Australian Radiation Laboratory on Lower Plenty Road, Watsonia. The purpose of my visits was to make an assessment of the ecological significance of the site.

The proposed site has no particular ecological merit. The native flora has long since been removed and what area has not been built over or used for stockyards is now a degraded pasture dominated by introduced species. Around the house and yards plantings of the original red gums *(Euc. camaldulensis)* have been made. In the event that the site is used for the proposed purpose these remnants of the natural flora could be advantageously incorporated into the overall design of buildings and ancilliary areas.

To the north of the site and almost contiguous with it a significant area of relatively undisturbed grassy woodland *(Euc. melliodora Euc. gonicalyx, Euc. camaldulensis - Themeda australis)* remains. A few trees have been removed and the area does suffer from some unnecessary vehicular tracks. However, the ground flora is fairly intact and still dominated by the native grasses and herbs. With relatively little effort this remnant of natural vegetation could make a valuable scientific and aesthetic contribution to the local environment.

D.J. Connor B.Agr.Sci., Ph.D.
Senior Lecturer in Agriculture,
La Trobe University.

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APPENDIX 7

SEISMIC RISK ASSESSMENT

G.Gibson, B.Sc.(Melb.), A.A.I.P., A.A.S.E.G.
Lecturer in geology/geophysics,
Preston Institute of Technology.

1. INTRODUCTION

There are two approaches to the problem of seismic risk. One is statistical in nature, where it is assumed that earthquakes occur at a steady rate, so that study of past seismic activity will enable prediction of future activity. The other is to monitor properties of the earth, such as water table level, electrical resistivity, seismic velocities, or magnetic fields, in order to determine changes which precede earthquakes. The first method gives an average seismic risk for an area, while the second gives the risk at a particular time. Both methods are only in developmental stages, especially when applied to areas of low seismicity. For the area under discussion, lack of seismicity data would make any estimates using the statistical method unreliable, and there is nobody working locally in the monitoring method. It is thus impossible to give a positive statement, or quantitative seismic risk figures, for the area concerned.

Australia as a whole has quite low seismicity with few earthquakes of large magnitude. However, a high proportion of Australian earthquakes are near the surface, and thus lead to high intensities over limited areas.

Although poor structures may be damaged by earthquake intensities of 6 on the modified Mercalli scale, it is quite possible to design structures that will not be damaged by intensity 8. In the past seventy years, Central Victoria has experienced a number of earthquakes with maximum intensities of 6 or 7. The most recent were at Mirboo North in 1969 (Wilkie, 1970), and in Westernport Bay in 1971 (Bishop & Cresswell, 1972).

2. ASSESSMENT OF SEISMIC RISK

Although no detailed seismic risk statistics exist for the area concerned, an idea of the order of magnitude to be expected may be gained by the study of preliminary figures produced for the Westernport Bay area (Underwood, 1969(. These show that an intensity of 5 may be expected every 10 years, and of 7 every 100 years. An extrapolation giving an intensity 9 every 1000 years is probably not valid.

A preliminary earthquake intensity zone map presented to a National Committee on Earthquake Engineering seminar (Adelaide, 1974) places the entire area around Melbourne and Westernport Bay in zone zero, a zone which should experience intensities of greater than 6.5 at average intervals of greater than 50 years. It must be noted that, due to lack of seismicity data, these preliminary estimates may be quite unreliable.

The building site is on folded Palaeozoic sedimentary rocks which do not have any particularly significant response to seismic waves. The nearest major fault that is known to be active is the Selwyn Fault to the east of Port Phillip Bay from Cape Schanck through Frankston and on to the north. This is about 20 km from the site.

There is a marked difference in elevation between the flat western suburbs of Melbourne and hilly eastern suburbs, and it has been postulated that the western area has been downfaulted along a secondary fault parallel to the Selwyn Fault. Such movement will have occurred in comparatively recent geological time, in a position which may be near to the Janefield syncline which is about 4 km from the site (Whiting, 1959).

3. CONCLUSION

The site has had a reasonably quiet recent seismic history, but it is quite possible that it will experience an intensity 7 earthquake during the life of the building. The design of any critical structures must take into account the lower, but non-zero, probability that higher intensities will occur.

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APPENDIX 8

ASSESSMENT OF METEOROLOGICAL CONDITIONS AT PROPOSED SITE

G.A.M.Kelly, B.Sc.(Melb.).
Meteorologist, Commonwealth
Meteorological Research Centre.

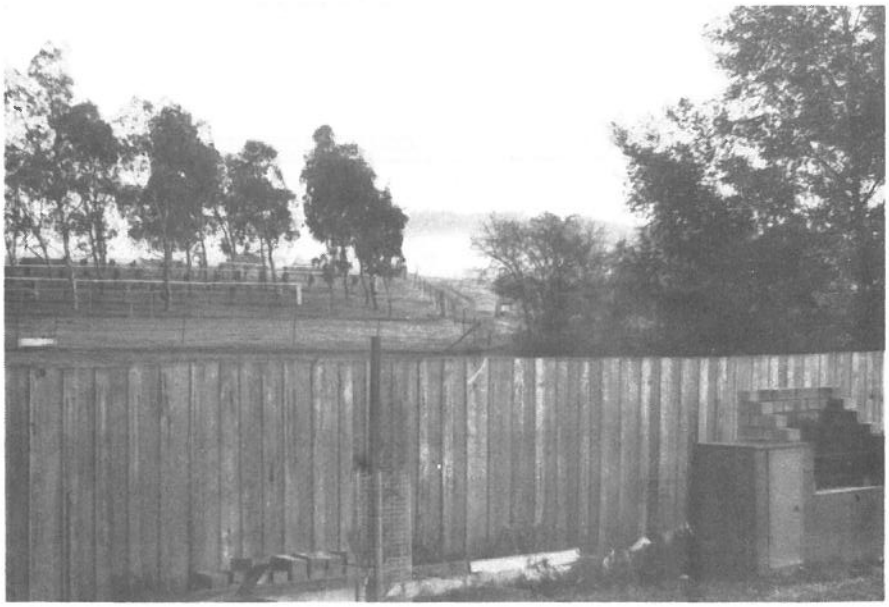
The proposed site is located in hilly terrain near the bottom of a valley where meteorological conditions often vary considerably from those which prevail in open areas (see attached photograph). It is difficult to apply to the site routine meteorlogical measurements which are taken by the Bureau of Meteorology at Melbourne or Laverton. Hence it is considered that there should be a series of meteorological measurements taken at the site for a period of three to five years to assess the air pollution potential of the area.

An example of the local conditions which do commonly occur is shown by a series of photographs (see attached) taken on Sunday 30 June, 1974 at approximately 10 a.m. The photographs are taken across the proposed site and show a low level inversion which traps a shallow layer of fog across the site. These conditions normally are not found on the top of ridges or in the open areas towards Melbourne. This type of small scale stable weather condition often occurs in the valley.

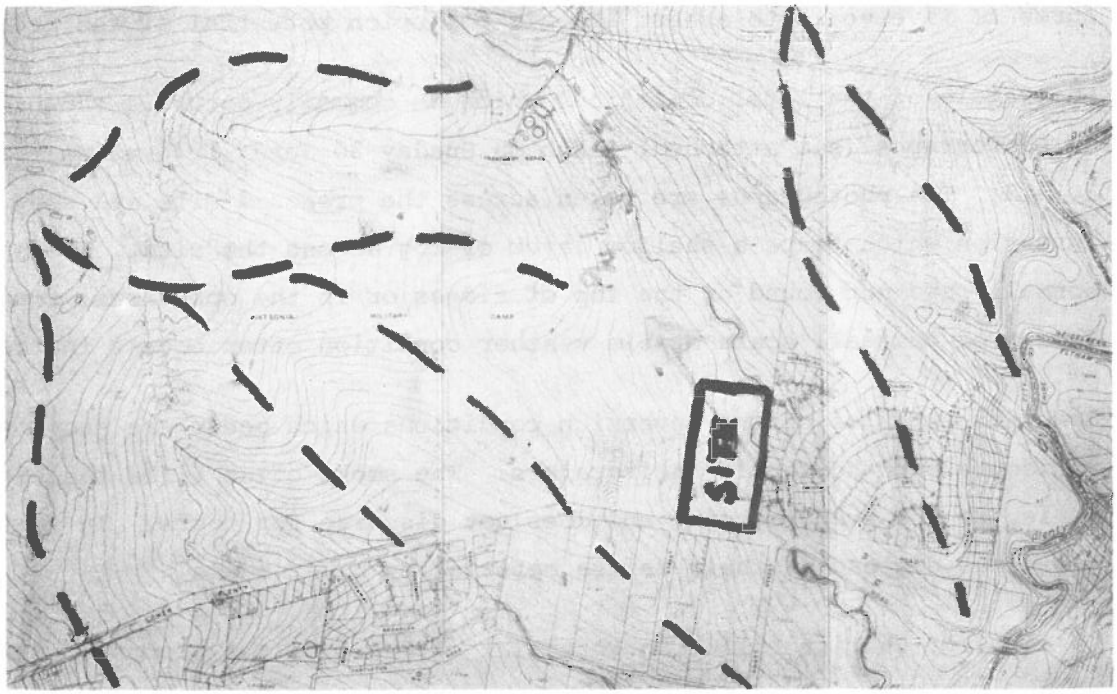
Constant examples of the inversion conditions which occur are shown when local residents burn household incinerators. The smoke often fills the bottom of the valley at the proposed site and does not disperse for hours. In fact many residents dispose of their refuse material by other means.

In summary, the Air Pollution Potential (A.P.P.) of the proposed site is considered to be much higher than A.P.P. at an open site or at the top of a ridge. Any emission of pollutants from heating plant or from work activities, would have to be controlled to a very high degree. However it is important to study the micro climate of the area in much more detail before any conclusions are made.

APPENDIX 8



Shallow Inversion Layer Trapping Fog Across Proposed A.R.L. Site.



Ridge and Valley System Yallambie District. (Ridges - broken lines)

Inversion and Fog - Proposed A.R.L. Site.