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PRT001/2002
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Dear Sir / Madam,

SUBMISSION REGARDING THE NATIONAL RADIOACTIVE WASTE REPOSITORY DRAFT EIS

INTRODUCTION

The Australian Space Research Institute Ltd (ASRI) wishes to express concerns about the proposed location of the National Radioactive Waste Repository ('the Repository') at Site 52a near launch and target areas on the Woomera Instrumented Range (WIR) within the Woomera Prohibited Area (WPA). ASRI strenuously urges that the Repository be located no closer to the WIR than Sites 40a or 45a.

ABOUT THE AUSTRALIAN SPACE RESEARCH INSTITUTE (ASRI)

ASRI is a non-profit organization entirely funded through member contributions and corporate sponsors. ASRI's goals are to develop and advance Australian space science and technology by conducting, encouraging and promoting research in these fields. Many of the professionals currently working in Australia's space industry have backgrounds in ASRI. More information about ASRI is available at www.asri.org.au.

ASRI'S ACTIVITIES IN THE WOOMERA INSTRUMENTED RANGE

ASRI has been launching rockets for experimental and educational purposes in the WIR since 1992. From 1997 to the present, an average of 8 rockets per annum have been launched as part of ASRI's Small Sounding Rocket Program (SSRP). These launches take scientific payloads to 2000 km/h and an altitude in excess of 20,000 ft. Payloads have been supplied by a wide range of researchers, including:

- the Commonwealth Government,
- industry,
- Australian universities,
- foreign universities, and
- Australian primary and secondary schools.

ASRI provides the SSRP service to the Institution of Engineers - Australia, and Kistler Aerospace Corporation as first prize in the annual Kistler Space Endeavour competition.

In addition to the SSRP, ASRI has built and tested rockets of its own design in the WIR, and ASRI has collaborated with overseas organisations that are seeking to do the same. ASRI's ability to conduct trials in the WIR is its most valuable asset and its major source of revenue. ASRI has recently announced as its top priority the expansion of its trials activities in the WIR.

COMMENTS ON THE DRAFT EIS FOR THE REPOSITORY

ASRI does not question the need for the Repository; however, we are concerned about the preferred location of the Repository, Site 52a within the WIR, because of:

- flaws in the EIS risk analysis, including incorrect evaluation of the:
 - probability of an impact affecting the Repository,
 - kinetic energy required to penetrate the soil covering the Repository, and
 - consequences of an impact on the Repository;
- the EIS risk analysis being based only on current year trials and short-term plans, not the 250-year Repository lifetime; and
- failure to consider the effect of the Repository on potential future WIR activities.

Additionally, ASRI believes that the EIS overstates the security advantages of siting the Repository within the WPA due to the threat that the Repository would pose to ongoing WIR activity.

FLAWS IN THE RISK ANALYSIS

Incorrect Evaluation of Probability of Impact

Section 10.7.5 of the draft EIS states, in part (p.241) ...

"Information provided by Defence for weapons releases at the Range E target area indicates that the repository is located in an area where the risk [of an mishap] is 10^{-6} ."

ASRI is concerned that the calculation (which is not described in the EIS) of the probability of impact on the proposed Repository, were it to be located at Site 52a, is incorrect:

- The calculation apparently fails to take account of the area of the target (a 10,000 m² repository is much more likely to be hit than a 1 m² object).
- Comparison with relevant standards is not made, for example the *Flight Safety Code* issued by the Space Licensing and Safety Office (SLASO) permits only a 10^{-7} probability of impact per space launch on nominated high-value or sensitive assets and there is no guarantee that the Repository would not be declared such an asset in future.
- The calculation does consider the total risk from all activities over the 250-year lifetime of the Repository.¹ Based on the stated (p.241) impact probability of 4.2×10^{-5} per annum, the impact probability over the 250-year lifetime is therefore 1.05×10^{-2} . Thus, the EIS should have concluded that the mishap probability level (p.242, Table 10.1) over the lifetime of the Repository would not be level D 'Remote', but level B 'Probable' and should have **consequently evaluated the risk category (Table 10.4, p.243) of as 'Serious'**. This surely indicates that **Site 52a should not be the preferred location**.

The alternative method of determining the probability of impact mentioned in Section 10.7.5 and used in Section 12.5, based on the relative areas of the WPA and the Repository, is also flawed. This method assumes that there is an equal probability of impact over the entire WPA; however, Site 52a is located only 3 km from the rangehead, the launcher areas and various target areas. The probability of impact at Site 52a will therefore be much higher than in most areas of the WPA for almost all trials.

¹ The estimated 50-year operational life plus the post-closure institutional control period of 200 years implies a 250-year lifetime for the Repository.

Underestimation of the Impact Kinetic Energy Required to Disrupt the Repository

Section 10.7.5 of the draft EIS states (p.240-1) states ...

"Smaller, low velocity projectiles can be expected to fragment on impact with only limited ground penetration and are likely to damage only surface features or structures... The likelihood being assessed is that of an impact of a weapon with sufficient impact energy to penetrate the soil covering the repository to a depth of 5 m. These weapons are taken to be large bombs and missiles in excess of 250 kg impact mass."

These comments are not justified in the draft EIS, and our observations over ten years of activity in the WIR contradict them. In particular, ASRI has observed the penetration of spent rockets weighing only 38 kg and 43 kg to a depth of approximately 3 m into the ground (see Figure 1).



Figure 1. Tail end of a 38 kg rocket that penetrated 3 m into dense clay in the WIR after an un-powered / free-fall descent.

The ground at Woomera is generally a thin layer (approximately 0.3 m) of stony soil with dense clay underneath. The loose, bulldozed earth covering the repository is likely to offer far less resistance than the undisturbed ground. Thus it is entirely possible, based on our observations, that even small bombs and rockets could penetrate the Repository. Consequently, ASRI believes that the Repository is incompatible with most trials activities in that area.

Incorrect Consequences Evaluation

ASRI also believes that the assessment of the consequences of a mishap on the Repository (Section 10.7.5, p.243) as either 'Negligible' or 'Marginal' is inappropriate. Regardless of the consequences from a scientific perspective, the political consequences of a mishap would be very significant and attract considerable adverse publicity.

SHORT-TERM FOCUS OF RISK ANALYSIS

There appears to be no consideration in the draft EIS of future WIR activities for which the mishap risk levels may be significantly higher than those of current WIR activities.

Over the past 50 years, the nature of trials and space launch activities at Woomera has changed frequently. Aircraft have existed for about 100 years and space launch vehicle for about 50 years. No one can tell what new technologies may develop or what tests etc may be required over the next 250 years. Current re-entry vehicle, solid-propellant sensitivity, supersonic gliding tests, and scramjet tests, for example, were not foreseen when the range was first built. Thus, to analyse the long-term risk based on year-2002 RAAF weapons trials is not realistic.

EFFECT OF THE REPOSITORY AT SITE 52A ON FUTURE WIR ACTIVITIES

General Effect on Activities

Trials planning is based largely on the likelihood of the worst possible outcome. The presence of the Repository in the WIR would mean that one consequence of a mishap could be the dispersal of low-level radioactive waste. It is therefore highly likely that many future trials would not be permitted or would have to be adversely modified, trials insurance would be either become more expensive or unavailable, and potential WIR users would seek alternative sites, probably overseas, thus denying a financial benefit to Australia and potentially retarding the development of Australian space science and technology.

Trials have been conducted in the WPA for more than 50 years, and it is estimated that the Australian investment in Woomera has totalled over two billion dollars in 1989 dollars [Morton, P. *Fire Across the Desert*, AGPS, 1989, p.546]. The WIR/WPA is therefore a valuable national asset. A national radioactive waste repository, which ASRI believes is fundamentally incompatible

with rocket and weapons trials activities, will diminish the ongoing value of this asset, arguably the safest place on Earth to conduct trials activities.

Effect on ASRI Activities in the WIR

ASRI believes a national repository in site 52a is incompatible with ASRI's plans to trial larger rockets in the WIR. ASRI has project "Arundo" that is actively developing longer-range rockets than those used in the SSRP, being larger single-stage and two-stage solid propellant rockets. Trials are expected to commence in 2003. Also expected to commence in 2003 are innovative hybrid rocket (liquid oxidiser, solid fuel) trials. ASRI is also developing the large liquid-fuelled AUSROC III sounding rocket and a smaller AUSROC 2.5 rocket. These proposed rockets have aroused interest amongst the scientific community, and ASRI has several letters of interest from scientists wishing to use these rockets in hypersonic, microgravity, ionospheric, and avionics studies. During initial flight testing the reliability of these rockets will be unknown, and they might well pose a threat to the Repository in the event of a mishap.

ASRI is also pursuing partnerships with overseas groups who are seeking sites to trial their large rockets. The presence of the Repository in the test area would make the opportunity of testing in the WIR less attractive, or the insurance unaffordable or unobtainable.

Thus, ASRI activities as immediately foreseen would threaten, and be severely threatened by, such a repository.

FACILITY SECURITY

ASRI believes that the security advantages of siting the repository in the WPA have been overstated. ASRI understands there is just one continuously staffed checkpoint and that alternative routes into the WPA are generally unhindered. Further, any security advantages that exist are a consequence of trials activities; the very same activities that are threatened by the presence of the Repository.

RADIOACTIVE WASTE PRESENTLY STORED NEAR SITE 52A

ASRI notes that some radioactive waste is already stored at two sites relatively close to Site 52a. Siting the Repository outside the WPA, for example at Sites 40a or 45a or at greater distance, would provide an opportunity to rectify this hazardous situation.

CONCLUSION

ASRI believes that the proposal to site a radioactive waste repository near the launch and target areas of a rocket range is illogical and dangerous. In our opinion, the assessments in the EIS are based on:

- flaws in the current Risk Analysis, including an incorrect evaluation of the probability of impact, the kinetic energy required to penetrate the soil, and underestimation of the consequences;
- the Risk Analysis being based only on year-2002 trials and immediate plans;
- lack of estimation of the effect of the Repository on potential future WIR activities over the next 250 years; and
- an overstating of the security advantages of siting the Repository within the WPA.

ASRI considers the WIR/WPA vital to the advancement of Australian space science and technology. ASRI is convinced that a national radioactive waste repository at Site 52a will adversely affect the useability of the WIR/WPA and, consequently, the future development Australian space science and technology.

ASRI urges the selection of sites more distant from the test range.

Yours sincerely,

[original signed]

John Coleman
ASRI Chairman