Submission to the Nuclear Regulatory meeting on Security and Continued use of Radioactive sources
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Introduction

The authors of this submission have been interested in countering sabotage and terrorism activities long before the events of 9/11/2001. They are now members of the Permanent Energy Montoring Panel for Mitigation of Terrorist Acts (PMP-MTA) of the World Federation of Scientists based in Geneva, Switzerland and meeting in Erice, Sicily. At its most recent meeting in May 2008 the PMP-MTA submitted a report on Risks of Dirty Bombs which was accepted by the August 2008 meeting, the 50th in a series, of the Seminar on Planetary Emergencies. We attach this report as an addendum to this submission.[1] In 2006, the PMP-MTA submitted a report[2] on mitigating the consequences of an attack with biological weapons. Several important conclusions of our group we feel are appropriate to bring to your discussions, and also some questions that our conclusions raise.

The first conclusion is that there are major qualitative distinctions between the effects of a terrorist attack with biological agents and a terrorist attack with radioactive sources. In the case of an attack with biological weapons it is not unreasonable to postulate that if there is no adequate preparation and response, a public health consequence could be as bad as the 1919 world wide influenza epidemic which killed about 80 million people world wide. On the other hand, the epidemic caused no damage to property and no areas were rendered uninhabitable The PMP-MTA report of 2007 specifically addressed simple steps to be prepared for such a pandemic and contain it. Responding to the use of a Radiological Dispersal Device (RDD) or "Dirty Bomb", is far simpler than responding effectively to an attack from a biological weapon—especially one that could induce a pandemic.

An RDD with high explosive dispersing a source of 50,000 Ci source strength, "Dirty

[1] "Responding to the Prospect of Dirty Dust (the residue from a radiological dispersal device--RDD)," by The Permanent Monitoring Panel on Mitigation of Terrorists Acts (PMP-MTA). Presented at World Federation of Scientists, Erice, Sicily, August 23, 2008. To be found at http://tinyurl.com/4yjgsd

[2] " 'Conquering Pandemic Flu by Practical Measures,' as adopted by the Mitigation Sub-Group of the Permanent Monitoring Panel on Terrorism of the World Federation of Scientists, Erice, Sicily, May 22, 2006. Membership of the Sub-Group on Mitigation Aspects: Dr. Diego Buriot, Dr. Kevin Clark, Professor Baruch Fischhoff, Professor Richard L.Garwin (Chairman), Professor Pervez Hoodbhoy, Dr. Sally Leivesley, Professor Ron Manley, Professor Richard Wilson." (at http://www.fas.org/rlg/060521-flu.pdf)

Dust" would, if quickly recognized, kill nobody, and cause very few cancers even on the usual pessimistic linear dose response relationship for cancers. But it could make several square km of area "out of bounds" for many years resulting perhaps of removal of all buildings therein. We emphasize in the 2008 PMP-MTA report that the area is critically dependent upon the acceptable standard for occupancy. It is therefore crucial that any discussion of policy for the use of radioactive sources for any purpose, including the medical applications considered here, and for purposes yet to be invented, consider this standard for acceptable reentry and use of areas contaminated with radioactive material.

Most calculations, including those of the PMP-MTA presented in our report make major simplifying assumptions. Firstly that the Radiological Disperson device had actually been detonated and all material was dispersed.[3] Secondly that no cleanup procedures were adopted. If calculations using these simplifying assumptions indicate no problem, then the discussion can stop here. However if calculations using these simplifying assumptions indicate a problem, and that major actions, such as expensive replacement of sources by other devices, are desirable, then it is crucial that a more complete risk analysis should be done. Such further analysis, and perhaps experimentation, discussed below, are likely to be far less expensive than banning or restricting any source. We urge that these be considered with high priority.

Specific Recommendations of the August 23, 2008 PMP-MTA report

1. *States should ensure registration and cradle-to-grave tracking of radioactive sources with strength greater than a few curies, with effective measures to avoid orphaned sources. International support should be available to expedite the process, since potential target states have an interest in securing sources wherever they may be.*

2. *It is obvious that states should cooperate in designing and implementing detection systems for intense sources of gamma-radiation-emitting radioactive materials as they might be shipped (usually in heavy shielding) from their origin to where they might be used in a dirty dust attack.*

3. *States and local authorities must cooperate with competent central authority and expert consultants to ensure that they can issue a previously prepared communication, within about 5 minutes after a dirty-dust attack, that contains an early assessment and initial instructions what to do—initially to stay or get inside buildings and to remove outer clothing that might be contaminated.*

4. *Medical resources and first responders must be organized both to make radiation measurements and to provide care at the site of a potential explosion and at improvised, non-hospital facilities to avoid contamination of hospitals. The public must be educated and prepared for "self-help" in advance of the incident to ensure optimized community outcome.*

5. *States must be prepared within 48 hours after a dirty-dust event to provide specific*

[3] In Ref. 1, as indicated in the caption to the figure, we do assume a fraction of the radioactive material 0.200 as "respirable."

assessment of the distribution of radioactive contamination and assurance to the many individuals, enterprises, and households that they can safely pursue their activities in an environment in which radiation can readily be detected but is essentially harmless. Other groups will be slated for relocation, the most heavily contaminated regions first.

6. *The projected individual integrated dose mandating relocation is about 100 milliSv, with relocation or cleanup (if possible) on a timely basis so that this reference level of 100 milliSv is not exceeded.*

Evidently individual localities cannot independently prepare for radiological or dirty dust attacks; the world must do this efficiently in appropriate working groups. But the "security culture" for radioactive sources is quite independent and feasible, and a "safety culture" for society must be inculcated—beginning with the optional and occasional mandatory use of marked Emergency Exits in public buildings.

Acceptable reentry levels.

The projected reentry level of 100 milliSv mentioned in Recommendation 6 above should be carefully considered. It is crucial to recognize the fact that, unlike most chemical and biological exposures, radioactivity and its accompanying radiation can be measured at very low levels. The fact that no one would be killed and few develop cancer is in such contrast to the effect of many everyday activities, that it suggests that some reentry into an area with measurable radiaoctive deposition should be permitted. Indeed that is unquestioned for normal everyday exposures and should be an option for exposures after an accident. The average radiation exposure for someone living in the mile high city of Denver exceeds that of Washington DC partially because of greater cosmic ray exposure and partially because of the larger radioactive mineral exposures in the region. Yet none of us are aware of any person who declines to go to Denver on that account. There is a variation in exposure around the average, yet we know of very few persons who are interested in measuring their personal background. Clearly evacuation to avoid an average exposure less than this difference, even on average, could be considered extreme. One should also consider whether some persons in the affected region could reasonably be considered "radiation workers" as two of us (RLG and RW) have been considered for 60 years. Such would be permitted regular entry, but radiation badges would be used.

We also note that there has been a strong tendency to regulate public exposures to radiation on the basis of PEAK individual rather than average exposures. We note that ICRP recommened that exposures to the general public from ordinary man-made activities be kept below 1.7 mSv/year on average, and that peak exposures above that level not be a matter of concern. This was based on probability of fatal cancer caused by radiation, and the societal concern is for the total number of such cancers not for the individual. Early non-cancer fatalities (within a month) do not occur below a peak individual dose of about 2 Sv within a month. We urge that the meeting be careful to recognize this important distinction between peak and average.

Clean up after an accident

There are two accident situations which are regularly quoted as indicating that cleanup is very expensive because the radioactive materials bind to the walls and the ground. The calculations presented in the PMP-MTA report assume no clean up. The first was on the release of a source of about 1,600 Ci, the size contemplated in your meeting, in Goiania, Brazil where 4 people died. But there was no immediate understanding of the problem and many of the exposures were almost deliberate, including spreading the skin with the glowing Cs-137 powder.

The second was on the area around the V.I. Lenin Atomic Energy Station at Chernobyl. The source was perhaps 100 million Ci and a large area was evacuated. Officially the public is not allowed in the exclusion zone. Although many older people defied orders and returned, and this has been condoned, there has been no widespread return.

Both these events occurred before a worldwide understanding of the cleanup problem. One of us (RW) has been to the area around Chernobyl several times. Although a wash down of the major streets was begun soon after the accident, and this had some measurable effect, it seems that wash down of buildings and apartments was not attempted until late. This leads to questions which we suggest that your meeting carefully consider

(1) How effective will an immediate washdown of the area around the dispersion site be? (before the material binds to the walls) And how does this depend upon the chemical form of the specific radioactive material, in contrast to the wide range of fission products and their chemical forms?. The concern in this particular meeting is on the chemical CsCl which is deliquescent. This suggests that a wash down would be particularly effective. We are aware of no experimental data on this, but it should be cheaper to acquire the most crucial data than to engage in the interminable discussions that take place without data. If clean up even by a small factor (2-5) is possible, this greatly reduces the area of concern.

One of us (RW) who has been using radiation even before his professional life began, has spilled small radioactive sources (up to 0.1 Ci). He has carried out cleanup within minutes and there in no case was there detectable residual radioactivity. He has also measured radioactivity at many locations both at the Chernobyl nuclear power plant and the surrounding area. For example in December 1987, he measured in two deserted apartments in Pripyat and expressed publicly his willingness to live in such a place. The Cs activity (including both Cs-137 with a 30 year half life and Cs-134 with a 2.2 year half life) would have been reduced several fold since then. Indeed a few plant workers were living there at the time during the work week. We suggest that before any further major action on restriction of sources for medical purposes is taken, that studies be undertaken on the effect of immediate cleanup. For example, it is not obvious that a change from a CsCl source to a powdered metal Cs source with a 28.4 degree C melting point, , which has been proposed because it is harder to disperse, may be unwise because it may also be harder to clean up.

Finally we suggest that a risk analysis be undertaken before any further regulatory action. This could include three major steps. Firstly a discussion of the security of the source an probability of it being chosen for a terrorist action; secondly a calculation of the effects of dispersion, and thirdly an estimate of the cleanup probability. The final numbers should be

compared with the benefit of having the sources, including keeping alive the possibility that future societally beneficial uses can be found. In view of the time required to eliminate powdered Cs-137 sources worldwide, there is probably time to get right what we should be doing.