

PROTECTING AMERICA

A PROPOSAL FOR KI STOCKPILING

A Program for KI Distribution in Schools

Pro**KI**ds

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BACKGROUND

Considerable evidence exists to support the use of potassium iodide (KI) for protection of the thyroid gland from radiation released by a nuclear reactor or weapon. KI's well documented effect is to saturate the thyroid with non-radioactive, "cold" iodine, "filling it up" and thus preventing the absorption of radioactive iodine (RAI) which causes a highly aggressive form of thyroid cancer.¹

Children and adults under age 40 are the most vulnerable to RAI and require special protection in a radiation emergency. Fortunately, the near 100% safety and effectiveness of KI, and the relative ease to store and distribute KI tablets, means that the potential for a catastrophic radiological event can be greatly reduced. It is a step that should be taken.

THE DANGER

Reactors and bombs produce numerous radioactive toxins, but RAI is among the most plentiful and by far the most dangerous. When released, it can form an aerosol cloud which can travel for hundreds of miles downwind from its origin along an unpredictable path which is determined by wind, rain, and temperature. It can contaminate hundreds of thousands of square miles and threaten millions of people. This has happened more than once.

The Japanese bombings and nuclear testing in the 1950's demonstrated the danger posed by RAI. Today, nearly half of all exposed Japanese who were alive in 1945 suffer from thyroid damage, and residents of South Pacific islands (located hundreds of miles from the US test sites) have developed thyroid damage at epidemic rates.^{2, 3} In 1997, the US National Cancer Institute estimated that weapons testing in Nevada caused between 11,300 and 212,000 thyroid cancers among Americans.⁴ But it was the massive release of RAI from the Chernobyl nuclear accident that most vividly demonstrated the danger. A study by the United Nations concluded that RAI formed a plume which blew across Europe, touching down erratically, and causing 11,000 cases of thyroid cancer by 1999.⁵ The World Health Organization documented thyroid damage among children and young adults from the plume as far as 500 km downwind.⁶ Nothing else released at Chernobyl had a similar impact, leading the US Nuclear Regulatory Commission (NRC) to report "***except for thyroid cancer, there has been no confirmed increase in the rates of other cancers including leukemia***" and that "***the vast majority***" of these thousands of cancers occurred "***more than 50 km from the site.***"⁷

In fact, almost all cancer took place between 30 and 200 miles downwind of the reactor.

Only a small amount of KI was available at Chernobyl. [Soviet nuclear authorities believed it was unnecessary.] But once the accident occurred, those lucky enough to get KI were protected. As reported by the NRC "***thousands of measurements***" demonstrated that "***the use of KI by the Pripjat population was credited with permissible iodine content (less than 30 rad) found in 97% of the 206 evacuees tested at one relocation center.***"⁸ However outside of Pripjat, throughout Ukraine, Belarus, and Russia, where KI was not available, thyroid cancer spiked to epidemic levels.

But not in Poland, where stockpiled KI was distributed to 17 million people. As a result, Poland, alone among the countries in the region, has no known cancer attributable to Chernobyl.⁹ Remarkably, with the exception of gastric distress among recipients who received liquid KI, there were no other serious unwanted reactions (side effects) from the KI among the general population.

Certainly Americans deserve this same level of protection.

A PLAN TO PROTECT AMERICANS

Given the realistic possibility of a radiological emergency, authorities have the obligation to plan and prepare for KI's use. However, any plan for KI stockpiling must consider two factors.

First, It is impossible to determine where KI will be needed before an incident occurs. In fact, during an incident, authorities will be unable to tell where contamination has occurred because adequate monitoring does not exist. Thus, anyone located within 100 miles of a release is at potential risk and should consider taking precautions.

And second, for maximum effectiveness, KI must be started as soon as possible and used daily for an extended period in heavily contaminated areas. However, because of the drug's long production time, emergency supplies for immediate protection must be on hand prior to an incident, and a distribution method and procedure to obtain additional KI for long-term protection must be in place.

These factors suggest that any plan to protect the public must be:

1. Local. Short-term emergency supplies must be stored around nuclear power plants, and high-potential terrorist targets, in neighborhood locations which are convenient and well known to the populations at risk. Without local storage, the ability to deliver KI quickly to affected populations will be severely impaired.
2. Long-Term. Provision must be made to provide supplemental long-term supplies for contaminated areas where the danger will go beyond the short term.
3. Comprehensive. The risk in a nuclear accident could threaten people over a very large geographic area and could last for a matter of weeks.
4. Feasible. A method to quickly distribute KI to those who are most vulnerable must be in place. Merely having the tablets will do little good if there is no simple way to quickly get them into the hands of those who need them the most. Further, since distribution speed is essential, the distribution procedure must be simple and uncomplicated and avoid using resources (such as police or emergency personnel) that will be required elsewhere.
5. Flexible. The plan must be capable of adapting to unanticipated circumstances.
6. The stockpiled KI product must be:
 - A) Completely effective, completely safe.
 - B) inexpensive, long-lasting,
 - C) maintenance free, light-weight, take up minimal storage space,
 - D) easy to administer, easy to ship to where it is needed.

To meet these requirements, this plan recommends storing an emergency supply of KI tablets in every school within 100 miles of a nuclear power plant. These tablets would be distributed in the event of an emergency, and would provide short-term (six days) protection for children and their families. This will allow time to ship additional KI from a central national stockpile into areas where protection beyond six days will be needed.

HOW MUCH KI MIGHT BE NEEDED?

No one can say how many people would be affected by a radiation emergency since population densities vary greatly by reactor. However, all schools located within 100 miles of a nuclear power plant can be determined, and 1500 packages (each containing 6 KI tablets) should be stored in each.

In addition to the short-term (six days) supply held in every school, a national stockpile of 5,000,000 boxes of KI should be stored in a centralized location for shipment into possibly contaminated areas (within 100 miles of the release) once an accident has occurred. These tablets will provide the long term protection needed in places that are, or may be, contaminated by RAI.

For anyone in a contaminated area, FDA guidelines call for the administration of one KI tablet per day for as long as the threat continues. But the duration of the threat is dependent upon the amount of RAI released, the proximity to the release point, and the location of random “hotspots” along the path of the plume. The release point, of course, could be any terrorist target, any of the 104 US commercial reactors; any industrial, research or educational reactor; or any hospital that uses RAI in various therapies and tests. In other words, most Americans are at some potential risk, but there is no way to know the level of danger to any specific individual before an incident occurs.

But the danger posed by RAI is limited and highly defined by its 8.1 day half-life. RAI decays rapidly, and after 7 half-life cycles (about 60 days), 99% of the RAI will no longer be dangerous. Consequently, in heavily irradiated areas closest to the release point, threatening levels might remain in the environment for as long as two months. However, as the distance from the release point increases, the RAI is diluted, and the length of time KI needs to be taken is reduced.

Given the decrease in danger as a factor of distance, and in light of RAI’s 8.1-day half life, the short-term emergency supply of six tablets will be enough for most people. However, in contaminated areas near the source of the release, individuals will probably require supplemental tablets for longer-term protection. The amount that might be required is as follows:

Distance From Release Point	Number of Tablets Required (per person)
1 to 25 miles	40 to 60 tablets
25 to 50 miles	20 to 40 tablets
50 to 100 miles	6 to 20 tablets
Beyond 100 miles	2 to 6 tablets (if exposure indicated)

WHEN SHOULD KI BE TAKEN?

Experts disagree at what point individuals exposed to radiation should take protective actions to protect the thyroid from RAI. The International Commission on Radiological Protection (ICRP) has recommended an intervention threshold level of 1-2 rem, while the NRC’s guidelines do not call for action until a 5 rem threshold dose is reached. There is also disagreement if the tablet distribution area should extend to 10, 20, 50, or 100 miles from the reactor.

However, two technical studies on the expected consequences of serious nuclear accidents done for the NRC make these modest disagreements somewhat meaningless. **Both predict over 1000 rem at 25 miles, between 300 to 380 rem at 50 miles, and 70 to 100 rem at 100 miles.**^{10, 11} Accordingly, there can be little doubt that the threshold exposure to warrant KI administration could be reached well beyond 10 miles, and possibly as far as 100 miles downwind of any release of RAI (a fact illustrated at Chernobyl).

WHICH FORM OF KI SHOULD BE STOCKPILED?

KI is available in two forms, liquid and tablets. While liquid KI is appropriate for use by infants or others too young to take solid food, its weight, bulk, short shelf life, and environmental sensitivity limit its suitability for localized (school) stockpiling. Further, in its liquid form, KI can be a severe gastric irritant which can cause unwanted side-effects, however these side effects are absent if KI tablets are used. In addition, because liquid KI requires careful measuring by eye-dropper, we recommend it be kept only in hospitals where it can be administered by trained personnel.

KI tablets, on the other hand, are small, lightweight, and easy to store with no special maintenance. They are available in two strengths; 130 mg (full strength) and 65 mg (half strength). This plan recommends the storage of both sizes for short-term emergency and long-term needs.

Emergency (School) Storage: The 130 mg tablet is ideal for school storage and emergency distribution to all adults and children. It is very safe for use by children (who can take either a whole or half tablet), and its small size (about 9000 tablets per cubic foot) means a school would have no difficulty finding storage room. It has a ten-year shelf life. Further, the ability to split a 130 mg tablet into two 65 mg doses adds an extra margin of public safety in the event of unanticipated developments (or greater than expected demand) in a national emergency. Most important though is that because both children and adults can safely take the 130's, the use of a single size for both age groups will simplify storage and distribution logistics.

[The advantage of having just a single size was noted by the National Council on Radiation Protection (NCRP) who concluded "**For accuracy of administration, ease of distribution, and precise dosage, the use of a single dose form is a most desirable goal.**" They further stated that "**toxic effects are not noted with doses of 130 mg of KI per day given to children over a course of years**" and that in a radiation emergency, for simplicity, "**it seems reasonable to supply adult doses to children.**"¹²

The FDA cites KI's safety at either dose. They have written that 130 mg of KI would be "**extremely safe**" for school children and that "**the overall benefits of taking up to 130 mg of KI instead of the lower doses recommended for certain age groups far exceed the small risks of overdosing.**"¹³ In fact, regarding the 130 mg strength for **ALL** age groups, FDA has written that the possibility of side effects is insufficient "**to conclude, or even to suggest**" a significant number of serious reactions.¹⁴

Central Storage: As noted above, areas that are heavily contaminated will require more than a six day supply of KI. For this need, additional KI should be warehoused at a central location where it could be shipped as needed. Since storage space is not a major consideration, the larger 65 mg tablets should be used. Children would take one tablet daily for protection, while adults would take two. These tablets have a six-year shelf life and are conveniently packaged in boxes of 20 tablets per box.

DISTRIBUTION

In the event of a threatened or actual radiation emergency, authorities would have the flexibility to order schools in threatened areas to close, and to send each child home with one to three unopened packages of KI, each containing six tablets. (The decision to take the tablets would be left to the parents.) Thus, in one step, virtually all school-age children and their parents would receive enough KI to protect them for at least 6 days. If necessary, schools beyond the initial distribution area could also distribute their tablets if authorities saw value in this step.

For areas where authorities conclude that the danger may continue beyond 6 days, additional KI would be shipped to schools within the affected area where it could be easily distributed within the six days available. Distribution might consist of 2 boxes of 65 mg tablets (40 tablets) to people in areas within 25 miles of the release point, 1 box (20 tablets) for anyone located from 25 to 50 miles of the release), and additional six-packs for everyone 50 to 100 miles downwind. No additional product above the initially supplied six-pack should be required for anyone beyond 100 miles.

The essential feature of this plan is its flexibility. Because the six packs are available for immediate distribution to the most vulnerable groups, and because officials will have at least 6 days to prepare for and evaluate the need for additional KI, there will be time for events to dictate thoughtful action that would be most appropriate for the circumstances.

The plan's flexibility is enhanced by its simplicity. Problems with liquid storage are absent, and the six-packs are so small and compact that they can be kept virtually anywhere. Schools are the obvious place to keep KI tablets because that's where the children are, and schools are frequently designated as public shelters in emergencies. In addition to schools, KI six-packs could be kept at police and fire stations for protection of emergency response personnel, and at post offices for distribution to the general public if required.

FEASIBILITY

It is likely that the NRC reactor-design philosophy of "leak before break" would provide up to two days for KI distribution before a release occurs, and that the six days provided by the six-pack will be enough to obtain and distribute any additional tablets for long-term protection. Storing KI in schools and daycare facilities would be an effective and efficient way to get the tablets to those who need them most in the least amount of time. Under this approach, and under the circumstances where a release occurs during a school day, the vulnerable population is protected almost immediately. Yet even in a worst case (where a release occurs on a weekend and distribution is delayed until the following Monday), this would still be early enough (in most cases) to block 85% to 90% of the radiation that would threaten the children.

There is substantial value to starting KI even after receiving an initial radiation exposure because radiation effects are cumulative. Taking KI after an initial dose is extremely valuable since this prevents the build-up of additional RAI during the 60-day period it takes for the radioactivity to decay. Therefore, even in the event of a two or three day delay, it is important for children and young adults to begin KI use as soon as possible in order to minimize total exposure.

Of course, storing KI in schools and daycare facilities leaves pre-schoolers without tablets. However in many cases these children will have older siblings in school who will bring the protection home. But in cases where there are no school-aged children, tablets could be made available at police and fire stations, or be available at post offices, and liquid KI could be obtained at hospitals.

COST

KI is inexpensive. For 500 students and their parents (1500 packages), the cost per school would be \$2700 for 10 years of protection. The annual cost is just \$270 per school—or just 3 cents per adult dose, and half this amount for children. By virtually any measure, this is a modest cost for protection of the most vulnerable.

Boxes of 20 tablets of the 65 mg strength are also inexpensive. The cost per box is just \$5.80 each, and their six-year shelf life means the annual cost for a child's dose is only 4.8 cents.

Consider the financial impact of a radiation emergency. A nuclear attack or a nuclear accident on the scope of Chernobyl could potentially cause 15,000 to 50,000 cases of thyroid cancer. In addition, probably 3 to 10 times this number of people would suffer other thyroid problems, such as thyroid nodules or hypothyroidism. Medical costs to treat these injuries would be staggering, and the cost in human suffering (especially among children) would be incalculable.

(Some idea of the cost of a nuclear accident was presented in an April 2006 study by the International Atomic Energy Agency (IAEA)¹⁵, which found that, in Belarus, "*government spending on Chernobyl amounted to 22.3 percent of the national budget in 1991.*" The Report also found that "*In Ukraine, 5-7 percent of government spending each year is still devoted to Chernobyl-related benefits and programmes [though the accident took place 20 years earlier].*" The cost of a terrorist incident could be similar.)

Worse would be the psychological toll. Because cancer can take 25 years to develop, and because no one would know if they had received a cancerous dose, anyone who was unprotected will worry about their health for years. This has been observed among Chernobyl survivors who blame radiation for virtually every ailment they suffer. But it's a self-fulfilling prophecy. Widespread anxiety has led to significant stress among the entire population, which the IAEA report calls "*a paralyzing fatalism*". This has led to a consequent general deterioration of the health of the entire society at an enormous cost which cannot even be estimated. Clearly, if people understood that the small pills issued by the government would protect them, much of the future psychological "cost" of a radiation emergency would be avoided.

CONCLUSION

While the chances of a nuclear emergency are unclear, it is impossible to deny the realistic potential for one to occur. Unfortunately, the odds are not reassuring. Estimates cited in Congressional testimony by experts from the NRC (who tend to be optimistic) have suggested a 50% chance of an accident in any twenty-year period.¹⁶ And while no one can judge the likelihood of a terrorist attack or hostile nuclear action by a state (Pakistan, Iran, or North Korea, for example), this threat can certainly not be dismissed. Indeed, the cliché—"not if, but when"—is all-too frequently heard.

Despite this, current radiological response planning pays scant attention to the consequences of a release on most people. It focuses, instead, on measures directed only at the small number of people who are located within 10 miles of the release (who would be evacuated), and in trying to control food and water supplies. For reasons which are difficult to understand, the impact on anyone beyond 10 miles is scarcely recognized, and certainly not properly managed.

But responsible public officials have the obligation to protect everyone and to implement measures to minimize damage in a nuclear emergency. This responsibility should be neither questionable nor controversial, since the value of KI is acknowledged, and the 2002 Bio-Terrorism Act mandated expanded stockpiling. Even funding for KI is in place through Project Bioshield. And although the FDA, the National Academy of Sciences, the American Thyroid Association, the American Academy of Pediatrics, and numerous others have all urged KI's availability, neither the Bush nor Obama administrations have responded to these arguments. Instead, they have chosen to emphasize evacuation, and as a result, KI remains largely unavailable to most people. What is needed today are new plans that focus on how much KI to stockpile, where to store it, and guidelines for tablet distribution.

What is most disturbing about current response planning is that evidence indicates it won't work—and most officials know this. Limited evacuations will have limited effectiveness, and the ability to conduct a mass evacuation is highly questionable. In fact, a large evacuation could make things worse by clogging roads, interfering with response procedures, and increasing radiation exposure among unprotected people sitting for hours in traffic. Most troubling is that plans that limit KI distribution to ten miles may lead some to believe that if they are 11 miles away, they are safe and need not take protective actions. The consequences of this could be catastrophic. Further, the focus on intercepting contaminated food and water ignores NRC findings that the major initial threat in a release is inhaled RAI in the air, not ingested in food and water. Further, how authorities would find, destroy, and replace contaminated food and water has not been made clear.

No one disputes that potassium iodide is an inexpensive, highly effective method to add a significant level of safety in a dangerous world. Therefore, for authorities to ignore the warnings of experts and the experience of history, or to depend on plans that are known to be inadequate, is irresponsible. One can only wonder what explanation officials would give if tens of thousands of Americans developed avoidable cancers because no one had acted.

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