

# Let's Talk About Potassium Iodide

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#EPR2025

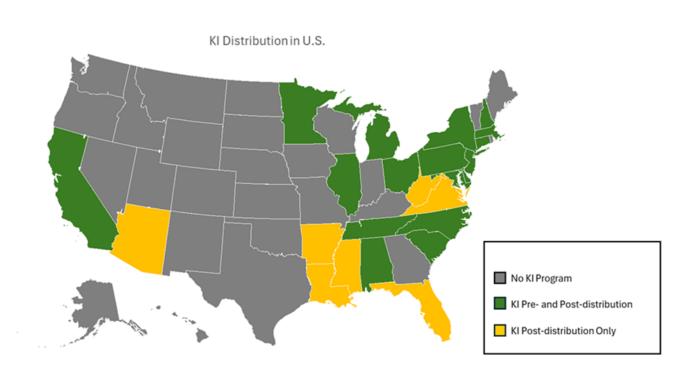


## Potassium lodide policy in the U.S.

- U.S. Nuclear Regulatory Commission (NRC) regulations require consideration of KI as a supplemental protective action to evacuation and sheltering-in-place
  - regulations and guidance are specific to large light water reactors
- Federal policy recommends KI to be stockpiled and distributed for emergency workers and institutionalized persons, and considered for the public within the emergency planning zone around large light water reactors
- State and local governments decide whether to use KI for the public

## U.S. KI policy is evidence-based

- Efficacy and efficiency of KI implementation could benefit from modernization
- KI Subcommittee within the Federal Radiological Preparedness Coordinating Committee (FRPCC) is assessing the need for guidance updates
- KI guidance can benefit from:
  - insights on radioiodine release from state-of-the-art consequence analyses
  - lessons from past events
  - adequacy of dietary iodine sufficiency and daily iodine intake
  - advances in nuclear technologies
  - best practice





## Quality evidence is needed







## 3. Recommendation and public health recommendations

### Recommendation

During a radiological or nuclear emergency, provision of iodine thyroid blocking (ITB) to people who are at risk of being exposed to radioiodine should be implemented as an urgent protective action, within the frame of a justified and optimized protection strategy.

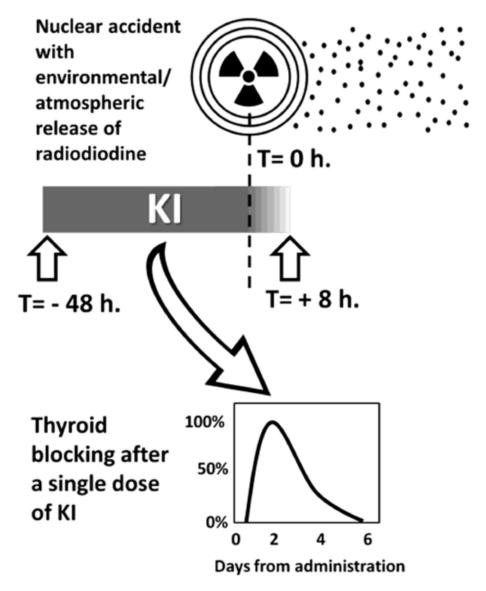
Quality of evidence: very low

Strength of the recommendation: conditional

## WHO recommends further KI research:

- radioiodine biokinetics
- optimal timing of intake
- feasibility and acceptability
- best practices for stockpiling or pre-distribution

## KI effectiveness depends on many factors



Ilias I.,Rizzo M., Meristoudis G. Potassium Iodide in Nuclear Accidents: Give it Timely, Swiftly and Judiciously. *Endocr Metab Immune Disord Drug Targets*; 23(6):873-875; 2023.

To be effective against inhalation exposure, KI must be administered within a specific time window

- < 12-24 hours before exposure ~90% to 70% effective</p>
- < 1-3 hours after exposure ~85% to 50% effective</p>
- > 6 hour after exposure has negligible protective effect

Modeling can provide useful insights for informing KI implementation strategies. Factors include:

- source term (optimal timing and radioiodine form)
- KI time dependency (biokinetics)
- iodine sufficiency (biokinetics)
- distribution strategy (feasibility)
- human factors (acceptability)
- state of practice (best practice)

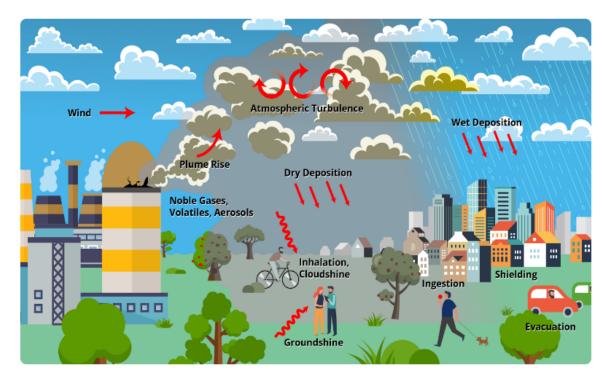


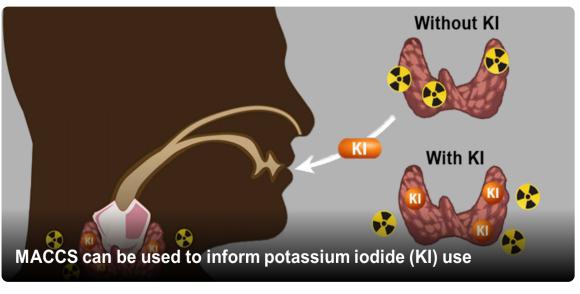
### What is MACCS?

- MELCOR Accident Consequence Code System
- Analysis tool for developing realistic estimates of consequences of nuclear power plant incidents
- Developed by NRC and Sandia National Laboratory
- Extensive use by NRC and domestic and international organizations

### How is MACCS used?

- Consequence studies
- Level 3 Probabilistic Risk Assessment (PRA)
- Cost-benefit analysis
- Risk-informed decision-making







## NRC is using MACCS to assess KI strategies

Literature Review: Evaluation of Implementation Strategies for Potassium Iodide

MACCS models effectiveness of KI implementation:

- KIMODL determines whether to consider KI or No KI
- Linear no-threshold (LNT) dose-response model applied
- Thyroid dose to a population is reduced by a factor

 $(1 - EFFACY) \times POPFRAC$ 

where,

EFFACY reduces the dose to the thyroid from inhalation (value: [0-1])

POPFRAC is the fraction of a cohort that ingests KI (value: [0-1])

### Scenarios to model in MACCS

No KI

KI pre-distributed

KI picked up at distribution centers/shelters

KI stockpiled – delivered when and where needed

## NRC tools demonstrate benefits of masks



#### RASCAL

Radiological Assessment System for Consequence Analysis for radiological emergencies

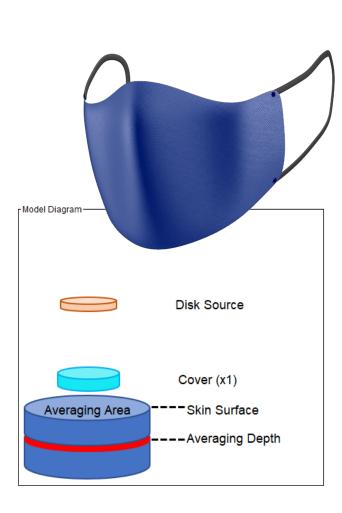


### VARSKIN+ (integrated with Radiological Toolbox)

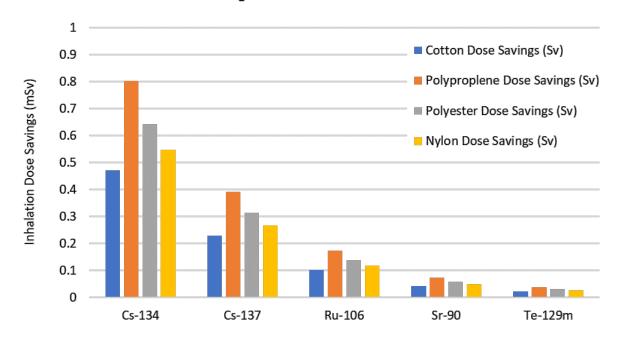
Dose calculation for skin contamination

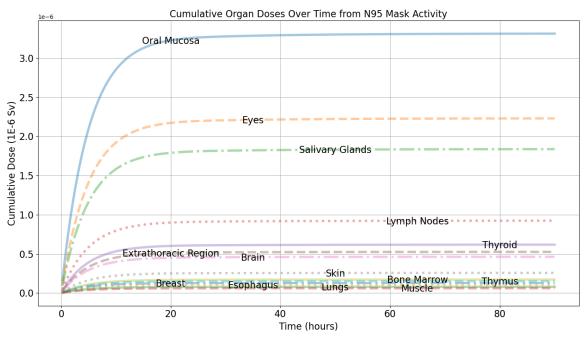


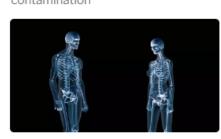
**PIMAL** Phantom with Moving Arms and Legs



#### Inhalation Dose Savings for Various Nuclides and Mask Materials

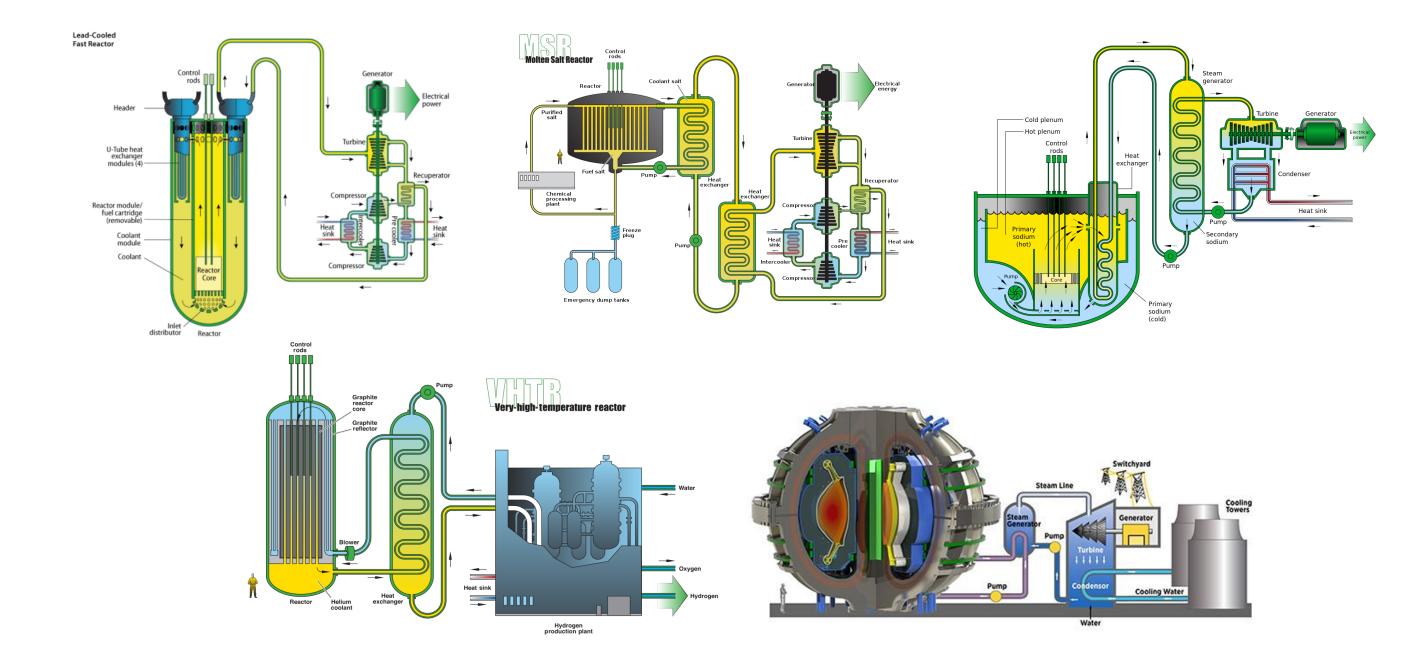






### $\equiv$

## KI use depends on the technology



## Communication is key

NRC Literature review revealed communication is vital part of strategy

Accurate information on KI is readily available to the U.S. population

- Search engines provide information from credible sources (e.g., Federal agencies)
- The terms "magic pill" or "anti radiation pill" still lead to good information
- Public interested in KI use during pregnancy and dose to children

Federal guidance will be updated to address effective strategies and applicability to advanced nuclear technologies

## NRC supports effective KI policy in the U.S.

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