UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

DEC 24 1990

MEMORANDUM FOR: Eric S. Beckjord, Director
Office of Nuclear Regulatory Research

FROM: Warren Minners, Director
Division of Safety Issue Resolution
Office of Nuclear Regulatory Research

SUBJECT: TASK ACTION PLAN (TAP), POLICY RE-EVALUATION REGARDING POTASSIUM IODIDE (KI) USE DURING A NUCLEAR PLANT ACCIDENT

Enclosed is DSIR's Task Action Plan for the subject effort. This task was recently reassigned to the Reactor & Plant Safety Issues Branch to achieve a more suitable distribution of Division resources while also insuring a fresh re-evaluation of the wide range of qualitative and quantitative issues involved.

The re-evaluation will integrate various qualitative issues into a revision of previous analytical results regarding KI use after a severe nuclear power plant accident. At issue is the degree to which account should be taken of the additional benefits of preventing serious health problems (potentially cancerous thyroid nodules) versus only accounting for the dollar cost of treating such nodules once they occur. Stockpiling of KI for distribution following an accident could prevent formation of a significant number of such nodules.

This re-evaluation will use the most recent information regarding the benefits and costs of using KI, and will consider primarily initial stockpiling and then subsequent distribution of KI as soon as possible after an accident. KI distribution before an accident will also be considered, although it is believed that this option introduces significant problems regarding actual availability to the individual when needed, and is less cost effective than simple stockpiling with post-accident distribution.

This work will be coordinated throughout its performance with the members of the Federal Radiological Preparedness Coordinating Committee (FRPCC) and its chair agency, the Federal Emergency Management Agency (FEMA). [The NRC is a member of the FRPCC.] A formal period for FRPCC and FEMA comment on the NRC staff-recommended policy is also included before presentation to the Commissioners.

If past procedures are followed during this coordinated effort, the NRC will provide its recommendations to FEMA (in its capacity

9702280139 901224
PDR ORG NIRCTN
PDR

as chair agency for the FRPCC), who will then publish a Federal Register Notice stating FEMA's recommended national KI policy on behalf of the FRPCC. If that policy is a recommended new Federal Rule or Regulation, the FEMA Federal Register Notice will be a request for public comments on that rule. Thus, if past procedures are followed, the enclosed TAP will be completed upon NRC's transmittal of our recommendations to FEMA, and FEMA will accomplish implementation of any new national KI policy.

The schedule given in the attached TAP assumes the start of contract work in April, 1991. This will necessitate a great deal of help from upper management in initiating a sole source agreement with MITRE or getting a Task Order under an existing DRA contract ("Rulemaking & Regulatory Analysis Support") with SC&A (SCIENTECH is a major subcontractor). Assuming the starting date is achieved, then a draft NUREG/CR report should become available in April, 1992 for staff utilization in preparation of a NUREG report describing options considered by the staff and the staff's recommendations. Allowing a reasonable time period for review and approval within the staff, ACRS, CRGR, and the EDO's office, followed by coordination and acceptance by FRPCC members, the completion date of May, 1993 shown in the TAP should be achievable.

If it is decided to deviate from past precedent and have the NRC publish any proposed new rule for public comment, then the schedule will be considerably extended, since publication of a proposed rule for public comment involves review by the staff, the CRGR, the ACRS, and the Commission both before and after such publication.

Warren Minners

Warren Minners, Director
Division of Safety Issue Resolution
Office of Nuclear Regulatory Research

Enclosure:
KI Task Action Plan

cc: J. Heltemes, RES
ACRS
F. Gillespie, NRR
F. Congel, NRR (FRPCC member)
L. Spessard, AEOD (FRPCC member)
R. Hogan, AEOD (31 copies, for FRPCC member agencies)
H. Thompson, EDO's office
P. Crane, OGC
L. Soffer, RES

ENCLOSURE 1

Task Action Plan
Reevaluation of Potassium Iodide (KI) Policy
(FIN L1844)

Lead Organization: Division of Safety Issue Resolution (DSIR)
Reactor & Plant Safety Issues Branch (RPSIB)

Task Manager: Roy Woods, x23908, MS: NLS308

Lead Supervisor: Gerry Mazetis, Section A Leader, RPSIB

RES Principal Reviewers:
1) Roy Woods, RPSIB, DSIR
2) Len Soffer, Severe Accident Issues Branch, DSIR

Projected Completion: May, 1993

with

Interim Commission Paper from Task 10 in June, 1991

1). DESCRIPTION

A. HISTORICAL BACKGROUND

The present federal policy regarding the distribution of potassium iodine (KI) around nuclear power plant sites for use as a thyroid blocking agent during or shortly after a severe accident was implemented by its publication in the Federal Register on July 24, 1985. Since the only authority to decide among available options regarding use of KI by the general public during an actual emergency rests with the responsible State and local health authorities, the policy consists of voluntary Federal guidance to those authorities. The voluntary guidance recommends that local authorities consider stockpiling and distribution of KI for emergency workers and institutionalized persons, but does not recommend pre-distribution or stockpiling for the general public. The basis for this guidance is that in the event of an accident, protective actions are planned and would be taken for the general public that are capable of reducing whole-body doses, not merely the thyroid gland's dose.

This policy was published by the Federal Emergency Management Agency (FEMA) in its capacity as chair agency of the Federal Radiological Preparedness Coordinating Committee (FRPCC). The NRC is a member of the FRPCC, and played a key role in development of that published KI policy through its sponsorship of a Sandia National Laboratory (SNL) analysis examining the cost-effectiveness of KI predistribution on a national basis (NUREG/CR-1433, published in 1980). The

results in that study were based on severe accident probabilities and consequences that were taken from the Reactor Safety Study (RSS), WASH-1400. In addition, other pertinent data (for example, the cost and shelf-life of KI and the risks to the thyroid due to internal radioiodine exposure) were based on information available in 1980.

Since then, several relevant qualitative matters have been raised which should be considered in a re-assessment of the U.S. policy regarding KI. Also, updates are appropriate in many of the quantitative factors that were used in developing the present KI policy.

The qualitative factors that should be taken into account include the degree to which cost-benefit ratios should be used in establishing the policy on the stockpiling or distribution of KI and the goal of preventing a potentially serious health problem (thyroid nodules, some of which will be cancerous) and not merely taking into account the dollar cost of treating such nodules once they occur.

The quantitative factors that have significantly changed since 1980 include: best estimates of the probabilities and consequences of severe accidents (e.g., NUREG-1150); estimates of thyroid risk as a result of radioiodine exposure; estimates of health risk to the public due to severe allergic reactions if large numbers of people take KI without medical supervision; and the cost and best estimate of the shelf-life of KI. Furthermore, information is now becoming available on the experience during the Chernobyl accident (April 1986) where significant quantities of KI were administered by Polish and Soviet authorities.

B. OBJECTIVE

The objective of this study will be to integrate the significant qualitative factors into a revision of the previous NUREG/CR-1433 analysis regarding cost-effectiveness of using KI after a severe nuclear power plant accident. The quantitative portions of this new analysis will use the most recent information regarding both the beneficial aspects and the costs of using KI, and will be primarily concerned with initially stockpiling, then subsequently distributing KI as soon as possible after an accident has actually occurred.

Predistribution of KI before an accident is now generally considered to be an undesirable alternative since it introduces significant problems and added costs which are not believed to be compensated for by risk reduction due to earlier KI availability. Nevertheless, in Tasks 1 and 4 below, the reasons for predistribution's un-acceptability

will be re-examined and documented, and if predistribution appears to be a viable alternative to stockpiling, then predistribution will be included as an alternative to stockpiling in this study.

C. REGULATORY USAGE

This effort will result in publication of a NUREG/CR report which will concisely identify, describe, and assess all significant qualitative and quantitative factors related to use of KI as a thyroid blocking agent. The report will be used by the staff as a basis for assessing whether or not to recommend to the Commission that it advise the FRPCC that the national KI policy should be changed.

2). WORK REQUIREMENTS

In performing the following tasks, the contractor should coordinate his work with designated contact persons from other concerned Federal Agencies (a list of such contact persons will be provided by the NRC Technical Monitor), making sure his work takes into account the interests and concerns of those agencies. To the extent possible, the contractor should utilize the technical consultation available within those agencies, requesting such expert advice through each agency's contact person.

The assumption is made that contract wo , will start in April, 1991. This will necessitate a great deal of help from upper management in initiating a sole source agreement with MITRE or getting a Task Order under an existing DRA contract with SC&A-SCIENTEC (SCIENTECH is a major subcontractor).

Task 1 - Literature Review

The contractor is to become familiar with the several qualitative factors that must be taken into account (in addition to quantitative cost-benefit analyses) in any restructuring of the national KI policy. The NRC Task Monitor will provide material which discusses the emotional stress and loss of work due to thyroid illnesses from iodine exposure which can cause thyroid nodules, thyroid cancer, and possible death. The contractor is also to become familiar with the methodology and assumptions used in NUREG/CR-1433, as well as recent information on severe accident probabilities and consequences (for internal and external events); estimated releases of iodine from such accidents; risks and associated impacts and consequences of thyroid exposure to radiation; cost and shelf-life of KI; and other pertinent information.

Recent internal NRC studies (which will be provided by the NRC Task Monitor) and information from the Chernobyl accident (as it becomes available) are also to be included.

In addition, the reasons for previous conclusions that predistribution is not an acceptable alternative to stockpiling will be re-examined and documented, and if predistribution appears to be a viable alternative to stockpiling, then predistribution will be included as an alternative to stockpiling in Task 3 (and later tasks) below.

ESTIMATED COMPLETION DATE: 5/91
ESTIMATED LEVEL OF EFFORT: 2.0 Person-months

Task 2 - KI Needed

Using information from Task 1 and the demographic population data for U.S. nuclear power plant sites, determine the distances from U.S. nuclear power plant sites where the thyroid dose to a child could exceed 50 rem and 100 rem, and determine the likely maximum number of people who should receive KI at each site in the event of a severe accident, making use of both dose values given above. If only children are to receive the KI, a discussion shall be provided which cites evidence that in a real event the children would actually be expected to receive the KI. Making use of recommendations from the available literature on KI dosage and accident duration, calculate the best estimate of the total quantity of KI that should be stockpiled (uncertainties in this amount, i.e. variations about the "best estimate" or "mean" value, should be treated as a parameter to be considered in Task 7, "Sensitivity-Uncertainty Analysis"). Based on available projections in population growth and the shelf-life of KI, provide best estimates of the required annual procurement of KI and the required stockpile quantities for each of the 25 years from 1991 through and including 2016 (the effects of considering a longer period, such as from license extension, should be included as part of Task 7). Based on anticipated losses of KI either in storage or during transportation (e.g. theft, breakage, contamination, or lost) estimate the recommended surplus needed to assure an adequate supply of KI.

ESTIMATED COMPLETION DATE: 7/91
ESTIMATED LEVEL OF EFFORT: 4.0 Person-months

Task 3 - Risk Without the Use of KI

Using the information from Task 2, calculate the thyroid illnesses and the estimated (equivalent monetary) cost to society of these illnesses assuming that KI is not available, but assuming that planned protective actions are carried out as realistically as possible. The uncertainty in this risk should be included as one of the parameters evaluated under Task 7 - for example, a range of effectiveness is possible for protective actions such as evacuation, and it is not known with certainty how effective such actions will be. The total risk is to include the costs of lost work time, emotional stress and decreased quality of life due to illness, and the costs to society of the fraction of such illnesses that cause death of the individual. The analysis is to consider both internal and external events, and is to include numerical results in a form to facilitate comparison to the NRC safety goal policy (such as quantitative health objectives).

ESTIMATED COMPLETION DATE: 9/91
ESTIMATED LEVEL OF EFFORT: 4.0 Person-months

Task 4 - Determine Effectiveness of KI Stockpiled at Various Potential Locations

Estimate the number and approximate locations where KI would have to be stockpiled in order to assure its timely and effective distribution to the affected populace. [If predistribution appears to be a viable alternative to stockpiling (as determined in Task 1), then predistribution will be evaluated as an alternative in this Task and the following Tasks]. Different radioactive releases (amount, type, and timing) should be considered so that the study represents the wide range of possible severe accidents. The effect of variations in stockpile locations shall be considered as part of Task 7. Using this information and considering the loss in effectiveness due to delay in distribution to the populace, calculate the decrease in thyroid illnesses and the consequent (equivalent monetary) savings to society attributable to stockpiling KI.

ESTIMATED COMPLETION DATE: 11/91
ESTIMATED LEVEL OF EFFORT: 4.0 Person-months

Task 5 - KI Costs

Using the latest available information on cost and shelf-life of KI, develop cost estimates to establish and maintain a national program for stockpiling KI. Factor in the estimated costs for packaging, warehousing, security, personnel, periodic replacement of KI, as well as the cost of the KI tablets. The experiences of the states that have stockpiled or distributed KI (Alabama and Tennessee) should be taken into account in estimating these costs. Each cost shall be separately identified and a discussion provided to explain its derivation. The cost (in terms of present worth) should be provided for the initial procurement of KI, warehouse space, personnel, and the projected costs for each year from 1991 through 2016.

ESTIMATED COMPLETION DATE: 12/91
ESTIMATED LEVEL OF EFFORT: 2.0 Person-months

Task 6 - Effectiveness (Value-Impact) Analysis

Using the information from Tasks 1 through 5, prepare a value-impact analysis involving establishment and maintenance of a national stockpile of KI in terms of such a policy's effects (value and impact) on society. This analysis is to include a computation and comparison of total risk with and without implementation of a new KI stockpiling and distribution program. These analyses shall be performed utilizing available cost-benefit techniques supplemented by methods that will have been developed to account for the qualitative factors considered in Task 1.

ESTIMATED COMPLETION DATE: 1/92
ESTIMATED LEVEL OF EFFORT: 2.0 Person-months

Task 7 - Sensitivity/Uncertainty Analysis

A sensitivity/uncertainty analysis will be provided to indicate the possible range of calculated KI-stockpiling cost/benefit ratios that result from the range in certain of the parameters utilized in the analyses (from site to site and over the spectrum of events considered), and to account for the present lack of knowledge regarding the actual value of those or other parameters. Probability distributions on key parameters will be assumed and propagated through the models using Monte Carlo simulation techniques. Key parameters include but are not limited to: variations from the "best estimate" or 'mean" value of the total quanti y of KI that should be stockpiled; variations in

effectiveness of assumed alternative protective actions such as evacuation; estimates of the probabilities and consequences of severe accidents, including the source term; estimates of thyroid risk as a result of radioiodine exposure; estimates of health risk to the public due to severe allergic reactions if large numbers of people take KI without medical supervision; the cost and estimate of the shelf-life of KI; the effects of considering a longer period, such as from license extension; and the effect of variations in stockpile locations. The sensitivities are to be presented in graphical form as well as in tabular form.

ESTIMATED COMPLETION DATE: 2/92
ESTIMATED LEVEL OF EFFORT: 2.0 Person-months

Task 8 - Draft Report Preparation

After completion of Tasks 1 through 7, a draft report will be prepared in the form of an NUREG/CR. This report will present the quantitative results of the analyses performed in Tasks 2 through 7, and it will also include a thorough discussion of the qualitative factors that must be considered along with the quantitative results in any Commission reassessment of the national KI policy. This report will be used by the staff as a significant portion of the bases for its discussions and recommendations to the Commission.

Computer codes that are used must be compatible with PC's in common use throughout the NRC. Such codes are to be discussed as to their assumptions and uncertainty related to use for this work. Sample code inputs ~~decks~~ and output results are to be provided as appendices. All modifications to all code(s) used shall be clearly discussed with the necessary information in an appendix so others could make similar modifications. These appendices should contain enough information that any person not familiar with this work could obtain the code(s) used, make the appropriate modifications, and obtain identical results to the sample results provided.

ESTIMATED COMPLETION DATE: 4/92
ESTIMATED LEVEL OF EFFORT: 2.0 Person-months

Task 9 - Final Report Preparation

After consideration of Staff comments on the draft report, a final camera-ready report will be prepared in the form of an NUREG/CR.

ESTIMATED COMPLETION DATE: 7/92
ESTIMATED LEVEL OF EFFORT: 2.0 Person-morths

Task 10 - Commission Paper Preparation, Review, Coordination, and Approval

The contractor's draft report (Task 8) will be used by the staff in preparation of a NUREG report for coordination with the FRPCC which outlines options the staff considered. The conclusions will discuss the contractor's technical findings, and compare them to the NRC's safety goal policy. The paper will give the staff's recommendation regarding which policy the Commission should recommend to FEMA (in its capacity as chair agency of the FRPCC) regarding KI stockpiling policy. The report will have been discussed informally with FEMA and the other FRPCC members throughout its development. However, a period is reserved for more formal coordination before the Commission approves sending its recommendation to FEMA (in its capacity as chair agency of the FRPCC).

SCHEDULED COMPLETION DATES:

RES Office Director's Concurrence: 7/92
ACRS and CRGR Review and Comment: 9/92
EDO Concurrence: 10/92
Discussion-Coordination-Modification in response to comments from FEMA and FRPCC members: 4/93
NRC approval, transmittal to FEMA (in its capacity as chair agency of the FRPCC): 5/93

This represents completion of the Task Action Plan (note the interim Commission paper pending the above final resolution given in Task 11 below).

Task 11 - Concurrent with the contractor's efforts (Tasks 1-8), but on a more accelerated schedule, the NRC Task Manager will prepare an interim Commission Paper outlining the objectives of the re-analysis in progress, including a discussion of the several qualitative issues that are being addressed in that re-analysis. This paper will also include a less rigorous in-house re-evaluation by the NRC-staff to provide an interim update to the Commission pending completion of

this Task Action Plan. Thus, the Commission will be appraised of qualitative and quantitative developments that have occurred since it last considered the KI issue in 1985, without the necessity of delaying receipt of such knowledge until completion of this Task Action Plan.

SCHEDULED COMPLETION DATES:

RES Office Director's Concurrence: June, 1991

3. TECHNICAL ASSISTANCE FROM OUTSIDE NRC

Tasks 1 - 8 will require technical assistance from outside NRC. The Office of Nuclear Regulatory Research will provide the funding for this work under FIN L1844. Funding has been allocated for the contracts and technical work on these Tasks will be initiated in early CY 1991.

a) Management of Work

The Office of Nuclear Regulatory Research [RES/Division of Safety Issue Resolution (DSIR)/Reactor & Plant Safety Issues Branch (RPSIB) is responsible for preparing and implementing a program to resolve this issue. A Task Manager in the RPSIB will provide management for all work identified in this Task Action Plan, including coordination of all work performed by other divisions and branches within RES. RPSIB will also be responsible for preparing the final resolution package referred to in Task 10, and the interim Commission Paper referred to in Task 11.