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**ENIWETOK CLEANUP CRITERIA FORMAT**

I am providing the attached draft format in response to your suggestion at the April 18, 1973, meeting with General Camm and Dr. Biles that we work together on this matter. As we have discussed, radiological criteria representing acceptable residual radiation conditions for rehabilitation must be formulated in anticipation of the return of the Eniwetokese people to their home islands. Although we are quite aware that these criteria cannot be expressed numerically until the results of the recent USAEC radiological survey are available, we visualize the format for the criteria as consisting of at least three essential parts; namely, assumptions, alternative actions, and the results of these alternative actions. With a short introductory statement and a concluding overview of the postcleanup radiological condition of the entire Eniwetok, we would like to suggest organization of the format as shown in enclosure (1). I hope that we can develop this format at an early date so that General Camm may discuss it with General Dunn in the near future.

Please let Commander Wolff or me know when you would like to discuss this.

(signed)  
John H. Carlson

to William W. Gay  
Captain, USN  
Assistant Director for Tests  
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Attachment:  
Eniwetok Cleanup Criteria  
(Format)

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*Recommendations*  
ENIWETOK CLEANUP CRITERIA

(FORMAT)

Viewed in any context, the radiologically safe resettlement of the Eniwetok Atoll is the ultimate goal of the preparatory cleanup/rehabilitation program. Since the repatriation of the Eniwetok natives is imminent, it is essential that the responsible U. S. government agencies insure that cleanup operations and resettlement of the atoll are effected in a manner that poses no unacceptable present or future radiological hazard to the <sup>returning</sup> ~~returning~~ Eniwetokese. <sup>to the</sup> ~~to the~~ <sup>Eniwetokese.</sup> Moreover, <sup>the</sup> ~~the~~ <sup>safety of the environment</sup> following cleanup and the projected well-being of the Eniwetokese people <sup>must be suitably supported and documented to bear detailed public scrutiny.</sup> should be publicized. As a minimum, and mindful of any resettlement restrictions, the same favorable sanction that was issued by the Ad Hoc Committee during the rehabilitation of the Bikini Atoll (Reference 1) should be reiterated by the <sup>an</sup> appropriate authority.

Combining the assessments of the radiological survey and knowledge of the expected lifestyles of the Eniwetokese, the atoll has been partitioned into a number of different entities which have within themselves commonality of geography or radiological environment or both. These are therefore termed "georadiological entities" and are listed in Attachment 1, which also shows their radiological conditions as determined by the AEC Radiological Survey.

Certain radiological categories are established which correspond to the gradations in radiological conditions reasonably expected to characterize Eniwetok Atoll geographically after cleanup operations. These radiological categories are given in Attachment 2 with accompanying descriptions and limiting radiological criteria. The following assumptions and alternative actions constitute the approach in trying to attain the best radiological category for each geographical segment of the Eniwetok atoll.

ASSUMPTIONS

- is an original description of the*  
*Report*  
(a) <sup>the</sup> AEC rad survey ~~reflects~~ <sup>reflects</sup> present radiological condition of Eniwetok Atoll, Island.
- (b) That the living and dietary habits of the Eniwetokese are thoroughly studied to ascertain, properly weight, and assess the various pathways leading to total radiation exposure of the populace. The details of such habits will be included.
- (c) That the maximum acceptable exposure doses (external plus internal radiation) to the <sup>future Atoll population</sup> resettled Eniwetokese people will not exceed FRC guidelines and will be kept as low as practicable. The following table has been developed to state these guidelines in terms of doses to the population. The entries in this table equivalent to the FRC guidelines are:

$X_1 =$   
 $X_2 =$   
 $\vdots$   
 $X_{24} =$

ADULTS (older than X years)

<u>YEARS</u>	<u>WHOLE BODY</u>	<u>BONE</u>	<u>THYROID</u>	<u>LUNGS</u>
5	$X_1$ (Rads)	$X_2$	$X_3$	$X_4$
30	$X_5$	$X_6$	$X_7$	$X_8$
70	$X_9$	$X_{10}$	$X_{11}$	$X_{12}$

CHILDREN (younger than X years)

<u>YEARS</u>	<u>WHOLE BODY</u>	<u>BONE</u>	<u>THYROID</u>	<u>LUNGS</u>
5	X <sub>13</sub> (Rads)	X <sub>14</sub>	X <sub>15</sub>	X <sub>16</sub>
30	X <sub>17</sub>	X <sub>18</sub>	X <sub>19</sub>	X <sub>20</sub>
70	X <sub>21</sub>	X <sub>22</sub>	X <sub>23</sub>	X <sub>24</sub>

- (d) That the contributions to accumulated dose arising from the indigenous <sup>food resources such as</sup> marine plants, fish, vegetation, land animals, and fowl can be assessed. <sup>estimated based upon any given settlement model.</sup>
- (e) That the bioenvironmental influence of the lagoon waters and lagoon ecosystems is sufficiently well known throughout the entire atoll.
- (f) That, if <sup>necessary, food supplements can be</sup> required, the necessary supplementary foodstuffs will be <sup>provided the Atoll residents</sup> made available to the natives for as long as necessary to compensate <sup>the denial of</sup> for naturally occurring food items <sup>the consumption of which may be considered</sup> prohibited for radiological <sup>reasonable from a radiological standpoint</sup> reasons.
- (g) That selected islands, parts of islands, or other areas on Eniwetok atoll can be effectively quarantined or otherwise <sup>restricted to use</sup> limited if deemed radiologically necessary.
- (h) That subsequent <sup>surveys and studies including population surveys</sup> radiological monitoring of the Eniwetokese natives and the atoll environment will be ~~programmed and performed~~ to assure continuing <sup>viability of the community, including approval of</sup> radiological safety. <sup>the degree of adherence to recommended constraints and precautionary measures.</sup>

ALTERNATIVE ACTIONS

The alternative actions represent those options available under the cleanup program for improving, if possible, the radiological condition

of any contaminated areas. Plausible alternative actions are:

- (a) Leave in present condition ?
- (b) Remove all <sup>recoverable</sup> tangible radioactive weapon debris
- (c) Remove all <sup>recoverable</sup> tangible radioactive scrap, concrete, structures or other debris having activities greater than \_\_\_\_\_
- (d) Soil removal ( \_\_\_\_\_ inches), plowing ( \_\_\_\_\_ deep) or covering ( \_\_\_\_\_ inches) operations to achieve radioactive exposure levels and concentrations of \_\_\_\_\_ or lower
- (e) Impose specific use, occupancy or visit restrictions.
- (f) Wait for \_\_\_\_\_ years.
- (g) Perform selected combinations of (a), (b), (c), (d), (e), or (f).

With the georadiological entities defined, their present condition stated, and plausible alternatives listed, criteria can then be established and expressed in a form such as Attachment 3.

From the compilation of such forms for all georadiological entities, decisions can be made to select some optimized set of radiological conditions for achieving an appropriate category for that entity. A final statement can then be prepared describing what the overall radiological condition of Eniwetok Atoll will be based on whatever combination of alternatives may be selected.

ATTACHMENT 1

GEORADIOLOGICAL ENTITIES

(FORMAT)

ENTITY

PRESENT CONDITION

All of island FRANK plus lagoon water to the \_\_\_\_\_ foot curve and the entire reef plate. The land area within coordinates \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_ are excluded.

Radiological Category: Visitable  
Doses to man if allowed to live without cleanup (Refer to table in assumption (c))

- X<sub>1</sub> =
- X<sub>2</sub> =
- .
- .
- .
- .
- X<sub>24</sub> =

Significant radiological problem(s) are:

1. Contaminated soil
  2. ....
  3. ....
  - .
  - .
  - .
  - .
- etc.

The land area within coordinates \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_/

Radiological Category: Restricted

- X<sub>1</sub> =
- X<sub>2</sub> =
- .
- .
- .
- .
- X<sub>24</sub> =

Significant radiological problem(s) are:

- 1.
- 2.
- .
- .

Lagoon area \_\_\_\_\_

$X_1 =$

$X_2 =$

.

.

.

.

$X_{24} =$

etc.



ATTACHMENT 2

Radiological categories have been established which provide guidelines about the safety and possible uses of specific atoll areas. The corresponding radiological criteria are presented as simple tables or rules.

Although the formal criteria appear to be quite straightforward, it is important to realize that the process of calculating or estimating a particular dose may be quite complex. In general, the cumulative dose is composed of the sum of the time-integrated constituent contributions. These constituent contributions include but are not limited to the following possible sources of radiological activity:

- (a) Distributions and concentrations of  $\text{Sr}^{90}$ ,  $\text{Co}^{60}$ ,  $\text{Cs}^{137}$ , and  $\text{Pu}^{239}$  etc., in air, soil, vegetation, land animals, water, fish, and other marine biota.
- (b) External exposure associated with the air, soil, scrap materials, structures, etc.

In examining any portion of Eniwetok atoll, the relative importance of these constituent contributions will vary on an island-by-island basis and will have to be assessed accordingly by knowledgeable technical personnel.

RADIOLOGICAL  
CATEGORY

DESCRIPTION

CRITERIA

Fully Habitable

Unconditionally Safe  
Permanent Occupancy -  
Surrounding media safe  
for fish, farming, and  
raising of livestock

X<sub>1</sub> =  
X<sub>2</sub> =  
:  
:  
X<sub>24</sub> =

Note: Allowances are made in these criteria for doses resulting from visits to areas designated "Arable" and "Visitable". This allowance is based on the Eniwetokese life-style models developed in the Radiological Survey Report.

Limited Livability

Conditionally Safe  
Permanent Occupancy -  
Safety of Surrounding  
Ecological Media  
Uncertain

X<sub>1</sub> through X<sub>24</sub> as above. Areas in this category are considered radiologically safe for occupancy provided that certain stated restrictions on potential sources of internal radiation, e.g., from suspect coconut crabs or pandanus, are adhered to. Occupants of such an area may or may not be obliged to obtain food products from other areas.

RADIOLOGICAL  
CATEGORY

DESCRIPTION

CRITERIA

Arable

No Permanent Occupancy  
Intermittent Visits  
Allowed -  
Ground and Water suitable  
for farming, fishing,  
and raising of livestock

Visit durations not to exceed:  
x hours/day  
y hours/year  
See note under "Fully  
Habitable" category

Visitable

No Permanent Occupancy  
Intermittent Visits  
Allowed -  
No use of vegetation,  
no farming, and no  
raising of livestock

Visit durations not to exceed:  
z hours/day  
q hours/year  
See note under "Fully  
Habitable" category

Restricted

No Occupancy  
No Visits Allowed

ATTACHMENT 3

CLEANUP CRITERIA SUMMARY SHEET

1. Georadiological entity: Island FRANK ---- etc.
2. Present status: Category "Arable"
3. Actions required to place in a less restrictive category:

a. Limited Livability

- (1) Leave in present condition
- (2) Wait for 28 years

Estimated Cost:

b. Limited Livability

- (1) Remove all tangible radioactive weapon debris
- (2) Remove all tangible radioactive scrap, concrete structures and other debris having activities greater than \_\_\_\_\_.
- (3) Remove 2 inches of topsoil to achieve radioactive exposure levels and concentrations of \_\_\_\_\_ or lower.

Estimated Cost:

c. Fully Habitable

- (1) Remove all tangible radioactive weapon debris
- (2) Remove all tangible radioactive scrap, concrete structures and other debris having activities greater than \_\_\_\_\_.
- (3) Remove 2 inches of topsoil to achieve radioactive exposure levels and concentrations of \_\_\_\_\_ or lower.
- (4) Wait for 7 years

Estimated Cost: