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1973 SEP 10 PM 3 24

U.S. ATOMIC ENERGY COMM.
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ROUND DRAFT
10 Sept. 1973
.W.Kerrick/D.Wilson

2. Radiological Implications of Data Obtained from the Survey

a. Guidelines against which Survey Findings will be compared.

The radiological survey of Enewetak Atoll provides a comprehensive data base needed to derive judgments and recommendations relative to the radiologically safe return of the Enewetak people. These judgements are based on an evaluation of the significance of all radioactivity on the Atoll in terms of the total exposure to be expected in the returning population, and recommendations as to reasonable actions and constraints which, where made, will result in minimum exposure.

The guidelines used in deriving these recommendations can be summarized as two interdependent considerations:

1. Expected exposure levels should be minimized and should fall in a range consistent with guidance put forward by the International Commission on Radiological Protection (ICRP) (see Table I and Appendix I for summaries of these radiological protection standards).

2. Actions taken to reduce exposures should be those which show promise of significant exposure reduction when weighed against total expected exposures and the "costs" of the actions. "Costs" in this context, are measured primarily in terms of costs to the Enewetak people as constraints on their activities or on added costs for cleanup or remedial action.

In these evaluations, it should be emphasized that doses through various pathways are estimated on the basis of environmental data and considerations of expected living patterns and dietary habits. While "radiation standards" do not exist for environmental contamination levels in substances such as soil and foodstuffs, there is general

agreement in terms of conservative models of these pathways and the relationships between a certain level in the environment and the likely dose to result from the pathway exposure.

The area of plutonium in soils, however, is one for which there is no general agreement as to the quantitative relationship between levels in soils and doses to be expected through the inhalation pathway, the primary one through which man can receive a significant dose from plutonium. The ICRP recommends a maximum permissible average concentration (MPC) of 1 picocurie per cubic meter ($\mu\text{Ci/m}^3$) of air for "insoluble" plutonium and $0.06 \mu\text{Ci/m}^3$ for "soluble" plutonium for unrestricted areas. While the plutonium in the soil at Keweenah is thought to be typical of world-wide fallout, and therefore insoluble, we will use the $0.06 \mu\text{Ci/m}^3$ value for the sake of conservatism.

A guide for assessing the importance of a certain soil level of Pu on Keweenah can be arrived at by a set of conservative assumptions regarding the resuspension pathway. This is the "critical" pathway since the inhalation route to man is more hazardous than the soil-root-pathway for ingestion of plants by man. These assumptions are:

1. Plutonium in soil is resuspended at rates similar to the soil material, e.g., the specific activity of soil equals the specific activity of air particulates.
2. All particles in air originate from local soil.
3. Plutonium in air is all in the respirable range of particle size and is soluble in lung fluids.

Appendix II develops average lifetime exposure to particulates in air by the returning population, combining the arguments outlined above with an analysis of air concentrations and time-of-exposure

weightings to be expected for the mix of environmental conditions associated with routine activities (ambient) and under special conditions which stir up the soil.

Estimated air concentrations of airborne particulate concentration ^{are} ~~are~~ published by the U. S. Dept. of Health, Education, and Welfare* for the year 1966 for thirty non-urban locations in the United States. No similar data are available for Brewster or an equivalent south sea island location. The average mean value for the 30 locations is ~~100~~ ³⁸ micrograms per cubic meter ($\mu\text{gram}/\text{m}^3$). Assuming, to be conservative, that the average airborne particulate concentration level at Brewster is ~~100~~ ¹⁵⁰ microgram/ m^3 , and further assuming that all of this particulate matter consists of local soil (i.e., no salt spray from the ocean) one obtains a value of ~~600~~ ⁶¹⁰ $\mu\text{Ci}/\text{gm}$ as an average surface soil concentration which corresponds to the ICRP guide for maximum permissible average airborne concentration of plutonium.

In the evaluation of the radiological condition of Brewster we will apply the criteria that areas in which any soil sample show concentrations greater than ~~600~~ ⁶⁰⁰ $\mu\text{Ci}/\text{gm}$ should receive corrective action, areas which show soil concentrations between ~~60~~ ⁶⁰ and ~~600~~ ⁶⁰⁰ $\mu\text{Ci}/\text{gm}$ may receive corrective action, depending on other radiological conditions present, and areas showing less than ~~60~~ ⁶⁰ $\mu\text{Ci}/\text{gm}$ do not require corrective action because of the presence of plutonium alone.

*Air Quality Data, 1966 Boston Area (See)

TABLE I

YEARLY DOSE LIMITS

	<u>Individuals</u>	<u>Population</u>
Osmium, red bone-marrow	0.5 rem/yr	
Skin, bone, thyroid	5.0 rems/yr	
Hands and forearms feet and ankles	7.5 rems/yr	
Other single organs	1.5 rems/yr	
Genetic dose		5.0 rems/50 yrs

**TABLE II: SECONDARY PARTICULATES,
INDUSTRY PREQUENCY DISTRIBUTIONS**

Station State & State or Park	Secondary Particles Mean				Station State & State or Park	Secondary Particles Mean			
	No.	Min No.	Max No.	% Per Year		No.	Min No.	Max No.	% Per Year
ARIZONA EMMET CANYON CO	69	38	212	2.31	RHODE ISLAND PARKER POINT CO	116	46	46	1.11
ARKANSAS MONTGOMERY CO	248	98	381	1.95	SOUTH CAROLINA FIELDING COUNTY	80	26	27	1.55
CALIFORNIA BIG SUR COUNTY	198	63	351	1.82	SOUTH DAKOTA BLACK HILLS	68	20	16	2.64
COLORADO FORT CARSON COUNTY	97	14	14	2.17	TEXAS PETEORUM COUNTY	200	78	24	2.79
CONNECTICUT HARTFORD COUNTY	126	66	217	1.52	VERMONT ORRANGE COUNTY	112	48	67	1.54
DELAWARE MONTGOMERY COUNTY	87	48	66	1.32	VIRGINIA SHENANDOAH PARK	78	26	20	1.86
IDAHO BLAINE COUNTY	120	40	23	1.75	WYOMING YELLOWSTONE PARK	30	12	9	2.67
ILLINOIS DELAWARE COUNTY	110	40	23	1.75					
INDIANA ACACIA NAT PARK	87	28	22	1.64					
MARYLAND COLEBROOK COUNTY	78	40	30	1.38					
MISSISSIPPI JACKSON COUNTY	223	87	91	2.23					
MISSOURI BIRKINBACH COUNTY	68	32	20	1.58					
NEBRASKA GLACIER NAT PARK	86	36	12	2.23					
NEVADA THOMAS COUNTY	60	27	27	1.85					
NEW MEXICO WHITE PINE CO	88	41	6	2.86					
NEW MEXICO COSUMEL COUNTY	83	24	23	1.86					
NEW MEXICO RIU SEVILLA COUNTY	86	76	23	1.63					
NEW YORK CAPE VINCENT	88	38	20	2.06					
NORTH CAROLINA CAPE HATTERAS	182	68	20	1.16					
NORTH DAKOTA LARD COUNTY	161	68	28	2.31					
OREGON CREST COUNTY	261	55	46	1.68					
OREGON LUTTY COUNTY	123	76	17	1.88					
PENNSYLVANIA CLAYTON COUNTY	67	57	20	1.58					

"UNION" LOCATION

DONOHOE 74 35 33 2.35

REYNOLDS ELECTRICAL & ENGINEERING CO., INC.

LSDB BIBLIOGRAPHIC DIRECT ENTRY DATA FORM

REPOSITORY _____

COLLECTION _____

LOCATION _____

1. TITLE/IDENT

DOCUMENT NUMBER 44865

TITLE

Memo to multiple addressees,
Subject: Draft material for report
by AEC Task Group on Recommendations
for Cleanup of Enewetak Atoll

YR MO DA

DOCUMENT DATE 73 08 - 29

ORIG DOC NBR _____

ORIGINATING AGENCY _____

CONTRIBUTING AGENCY DOE/McCRAWDOCUMENT CLASS UORIGINATING CLASS UDOCUMENT TYPE CO RTMICROFILM REEL 1051MICROFILM FRAME 0846MEDIA TYPE XDOCUMENT PAGES 2PRIVACY ACT CODE -----KEYWORD PRIORITY -----DOCUMENT APPROVED ---DOCUMENT COMPLETE -----MARGINALIA XSIGNIFICANCE -----

REVIEWER _____

12. DUPLICATE CHECK:

LAST THREE WORDS OF TEXT

by September 14, 1973

13. ENCODER

COMMENTS: This is an incomplete document.
