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Dr. Geoffrey Howe
Contractor-Columbia University
Phone: (212)-305-4601

**Possible Study of Leukemia in Liquidators in Ukraine
Following the Chernobyl Accident**

- Items for Consideration
- Aims
- Study Design
- Identification of Cases and Controls
- Tracing and Interviewing Subjects
- Estimated Power of Study
- Strengths and Limitations
- Methods of Dosimetry
- Possible Strategies for Using Dose Estimates

**POSSIBLE STUDY OF LEUKEMIA IN LIQUIDATORS IN UKRAINE
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Tracing and Interviewing Subjects

A) Retrospective cases

- ▶ traced through Chornobyl Registry and medical system
- ▶ interview by proxy (spouse and co-worker)

B) Prospective cases

- ▶ traced through medical system
- ▶ direct interview

C) Controls

- ▶ traced through Chornobyl Registry
- ▶ interviewed directly

D) Questionnaire

- ▶ dosimetric and epidemiologic
- ▶ developed in collaboration with IARC and EU
- ▶ extensively pre-tested

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Aims

- A) To estimate risk of leukemia as a function of moderate rate radiation exposure
- B) To collect biological samples for future study
 - ▶ only leukemia
 - ▶ no biological studies in Phase II
 - ▶ preliminary evidence of effect
 - ▶ no effect vs some effect
 - ▶ time dependency?
 - ▶ feasibility of collecting biological samples

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Study Design

A) Case-cohort or case-control based on defined cohort

B) Definition of cohort

- ▶ liquidators first working 1986-1990
- ▶ resident at time in one of 5 oblasts or Kiev City
- ▶ recorded on Chernobyl State Registry
- ▶ ~100,000 subjects
- ▶ + Ministry of Internal Affairs workers in same geographic areas?
- ▶ +-20,000 subjects
- ▶ Total subjects ~ 120,000 subjects

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Estimated Power of Study

Excess Relative Risk per Gray = (RBE) 2.19 Dose*

RBE	Hypothesis	Power (Number of cases)	
		Ukrainian Study	Combined Ukrainian, Belarussian and Russian Studies
1.0	RBE = 0.0	82% (260)	93% (360)
0.0	RBE = 1.0	72% (191)	83% (263)

* Based on atomic bomb incidence study

Linear time dependent and age at exposure dependent excess risk model

Duration of Ukrainian study = 1986 – 2011 (25 years)

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Strengths and Limitations

A) Strengths

- ▶ Phase 1
- ▶ Opportunity to study effect of moderate rate radiation on risk

B) Limitations

- ▶ retrospective cases
- ▶ dosimetry

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Methods of Dosimetry

Method	Applicable to	Comment
Official doses	44% of subjects	Unknown precision Problem of group doses
Soft assessment	All subjects	Useful if lack of detail Problem of proxies
Detailed assessment	All subjects	Useful if more detail Problem of proxies
FISH	Live cases; controls	Poor precision at low doses Feasibility?
EPR	Those with extracted tooth	Best precision (?) "Gold Standard" (?)

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Possible Strategies for Using Dose Estimates

- 1) Soft assessment for all subjects with correction for measurement error
- 2) Detailed assessment for all subjects with correction for measurement error
- 3) Mean of soft and detailed assessment for all subjects with correction for measurement error
- 4) “Best method” available for each subject
 - ▶ must specify order *a priori*
 - ▶ must stratify on method
 - ▶ cases and controls