

Epidemiology of Eldorado Uranium Workers 1950-1999

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Acknowledgment

**Eldorado management and board for
supporting the original study**

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current study**

Canada's Oldest Nuclear Company

Eldorado 1926-1988

SMDC 1974-1988



Cameco Corporation 1988-Present

Canada



Study Cohort

Port Radium 1930-1960

Beaverlodge 1948-1982

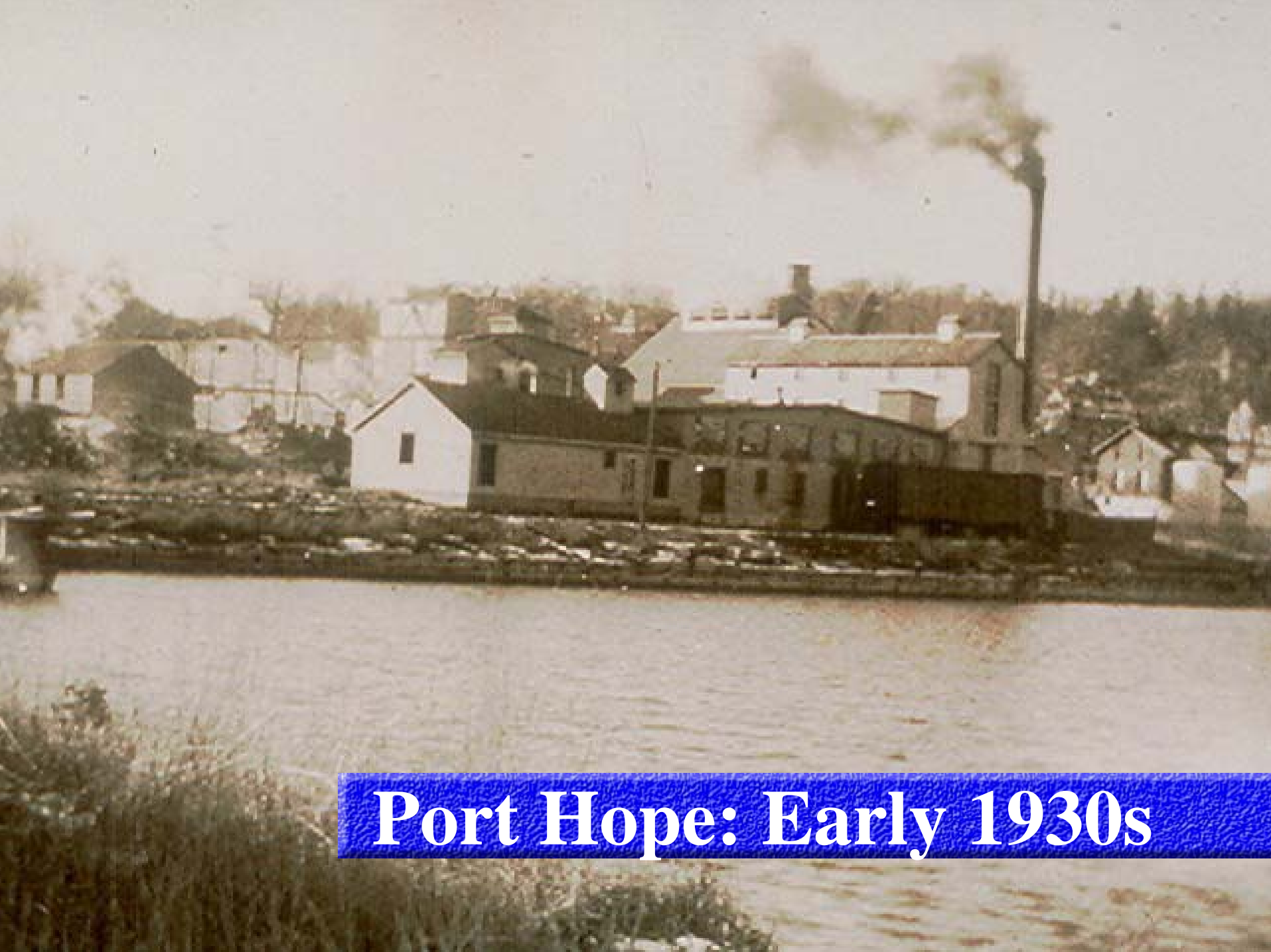
Port Hope 1932-1980

Support Staff 1932-1980

On payroll on 1 Jan 1950 or later

Port Radium 1930s





Port Hope: Early 1930s

Beaverlodge Operation 1953-82



Original Study 1950-80 Lung Cancer Risk

- **Beaverlodge** **3.28% per WLM**
- **Port Radium** **0.27% per WLM**

Cohort Preparation

**Addition of new Beaverlodge hires
after 31 Dec 1980**

**Extensive review of personnel files for
Port Radium & Beaverlodge**

New radiation exposure calculations

Radiation Exposure Estimates

- **SENES Consultants studies of Port Radium and Beaverlodge**
- **Seasonal and annual average WL**
- **Port Hope estimates based on material inventory and building configuration**
- **Gamma doses from area monitoring and early sample film badge use.**

Radiation Exposure Estimates

**Non-Eldorado exposures collected
by matching cohort to
National Dose Registry**

Cohort

- **19,855 individuals**
- **1,592 female**
- **17,660 suitable for analysis**

Statistics Canada

Alive follow-up match to tax file

Canadian Mortality Data Base 1950-99

Canadian Cancer Data Base 1969-99

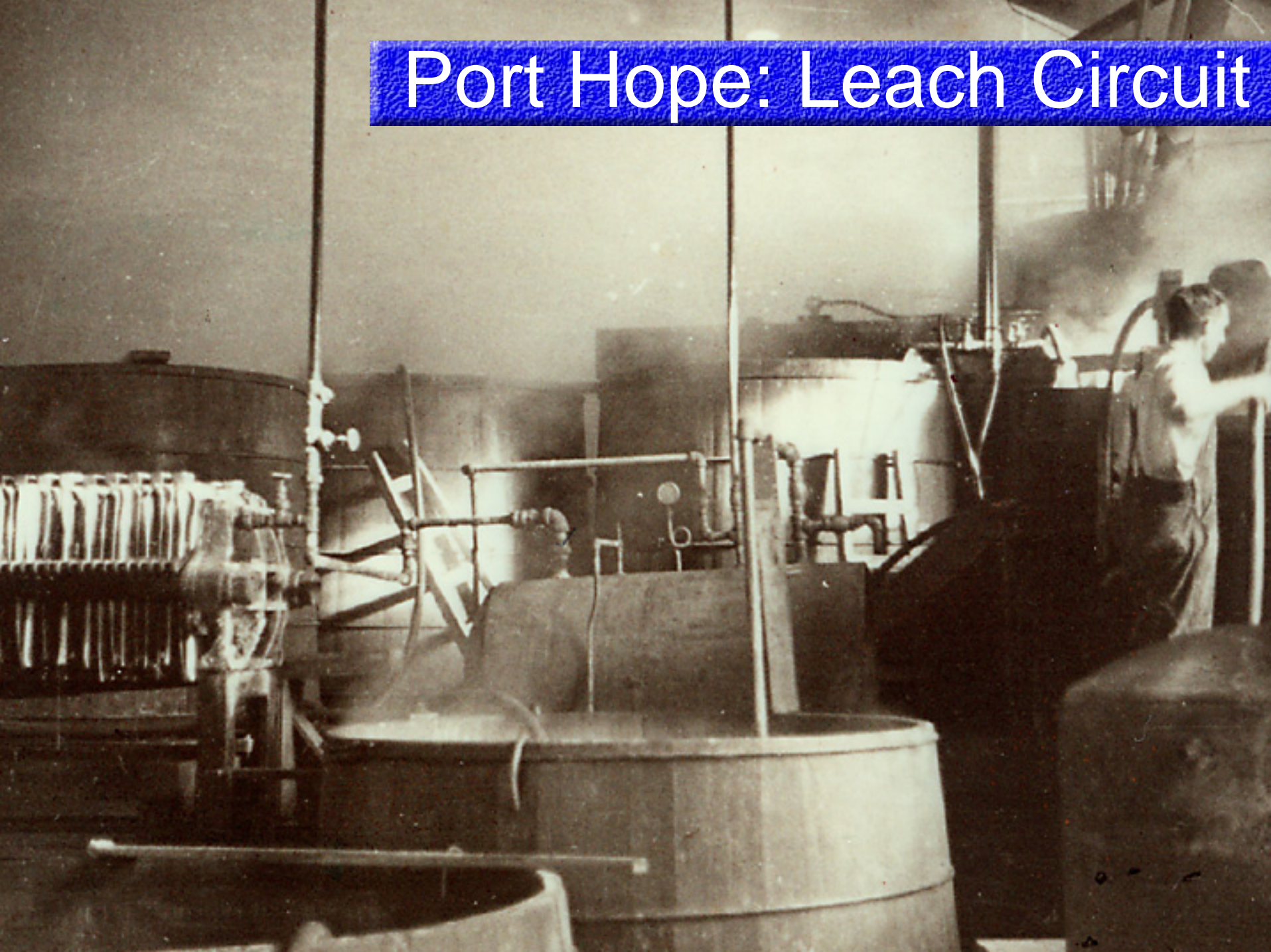
All Males

Cause	O	E	SMR
Lung Cancer	618	470.3	1.3*
Hypertensive	42	24.5	1.7*
Alcohol rel	54	34.8	1.6*
Motor Veh	180	139.1	1.3*
Suicide	208	122.7	1.7*
Homicide	28	14.7	1.9*
Other accid	365	215.6	1.7*

All Females

Cause	O	E	SMR
Lung Cancer	21	14.4	1.5
All Cancers	74	81.4	0.9
All Causes	184	234.2	0.8*

Port Hope: Leach Circuit





Acidifying
radium-
barium
carbonate

Port Hope Fractioning Lab



1 milligram radium needle



Port Hope Males

Cause	O	E	SMR
Lung Cancer	101	92.0	1.1
Hypertensive	13	4.9	2.7*
All Cancers	272	283.8	1.0
All Causes	1104	1077.5	1.0

Hypertensive Deaths

- **One coding error**
- **Multiple underlying causes**
- **Several diabetics**
- **At least 2 could have been coded as strokes**

Port Radium Males

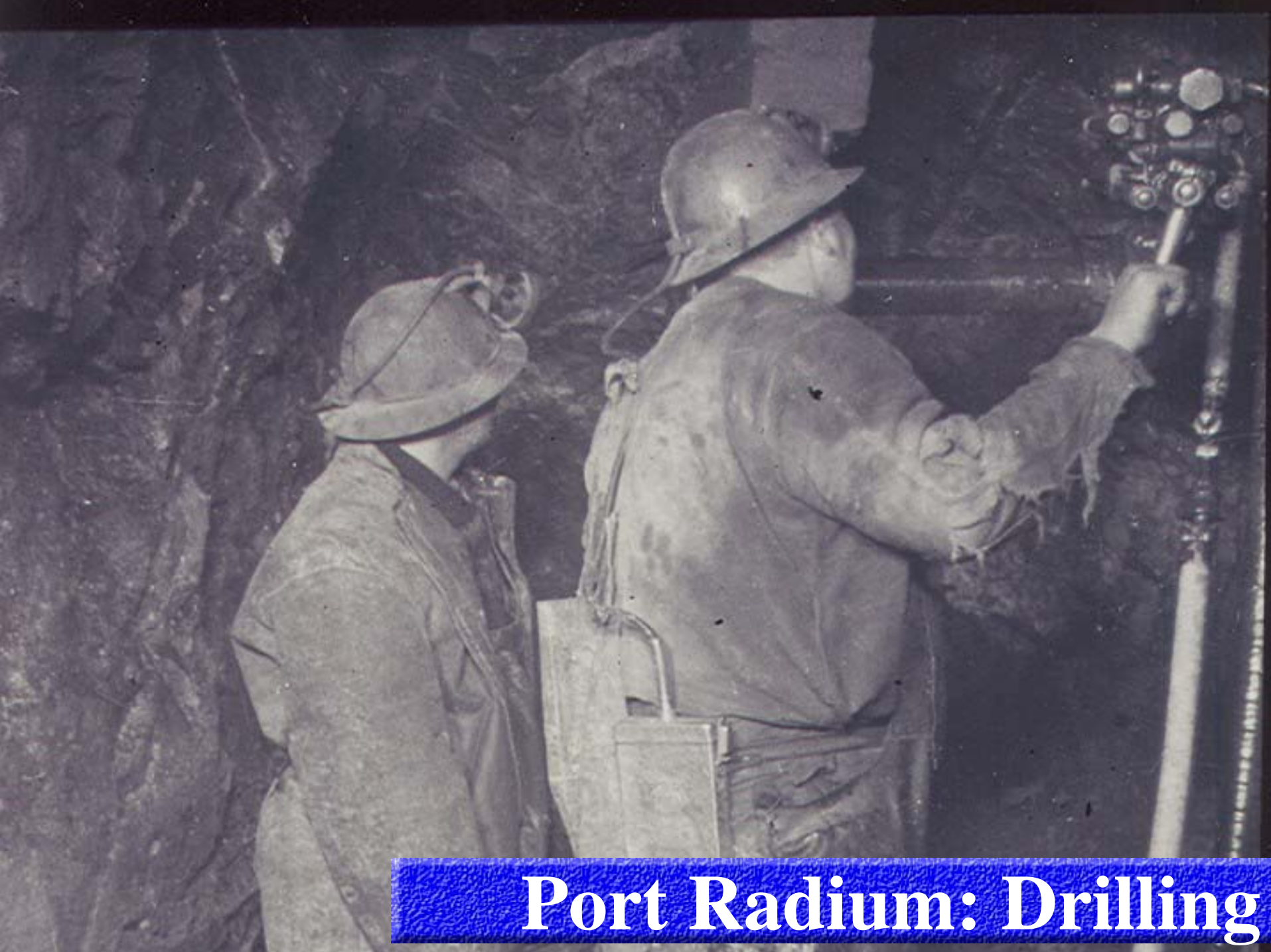
Cause	O	E	SMR
Lung Cancer	230	142.7	1.6*
Alcohol Rel	23	9.1	2.5*
Motor Veh	46	32.4	1.4*
Suicide	48	25.7	1.9*
Other Acc	110	58.1	1.9*
All Cancers	459	442.4	1.0
All Causes	1616	1700.5	0.95*

Beaverlodge Males

Cause	O	E	SMR
Lung Cancer	279	217.8	1.3*
Alcohol Rel	27	18.1	1.5
Motor Veh	105	76.2	1.4*
Suicide	139	69.8	2.0*
Homicide	20	8.7	2.3*
Other Acc	219	109.2	2.0*

Northern Mortality

- **Crude mortality in the northern territories vs southern provinces**
- **External causes 3x**
- **Suicides 2.5x**
- **Homicides 6x**

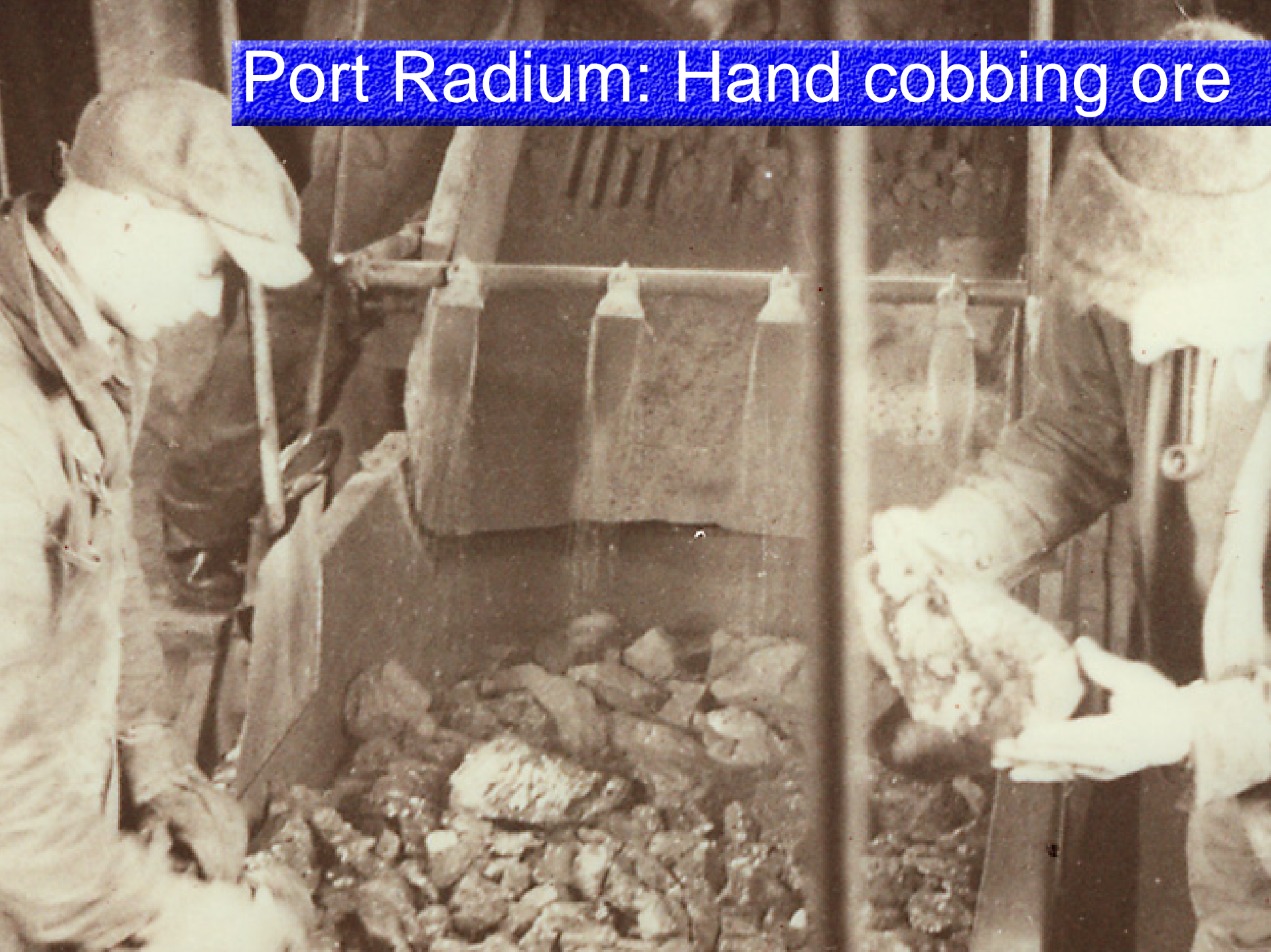


Port Radium: Drilling



Port Radium: Trammimg ore

Port Radium: Hand cobbing ore



Port Radium Underground

Cause	O	E	SMR
Lung Cancer	159	75.5	2.1*
Alcohol Rel	13	4.8	2.7*
Suicide	27	13.4	2.0*
Other Acc	74	30.6	2.4*
All Cancers	286	232.2	1.2*

Beaverlodge Underground

Cause	O	E	SMR
Lung Cancer	198	120.7	1.6*
Motor Veh	63	42.4	1.5*
Suicide	84	39.6	2.1*
Homicide	14	5.0	2.8*
Other Acc	148	61.1	2.4*
All Cancer	395	354.1	1.1*
All Causes	1348	1244.0	1.1*

Beaverlodge Mill Workers

Cause	O	E	SMR
Lung Cancer	24	28.1	0.9
Suicide	22	11.3	1.9*
All Cancer	68	83.5	0.8
All Causes	247	297.6	0.8*

ERR per 100 WLM

Site	Cases	ERR
All Males	618	0.55*
Port Hope	101	0.18
Port Radium	230	0.37*
Beaverlodge	279	0.96*

ERR per 100 WLM

Site	1986	Current
Port Radium	0.27	0.37
Beaverlodge	3.28	0.96

Why the changes?

- **Calculations significantly increased Beaverlodge doses**
- **Non-Eldorado dose was included**
- **Corrected many errors in the original cohort**
- **Added additional identifying info, improving mortality match**

Additional Observations

- Mill Workers & Port Hope Uranium Workers show no excess of kidney diseases**
- Port Hope Radium Workers show no excess of bone cancer & leukaemia**
- Port Hope Radium Workers have non-significant deficit of cancers**

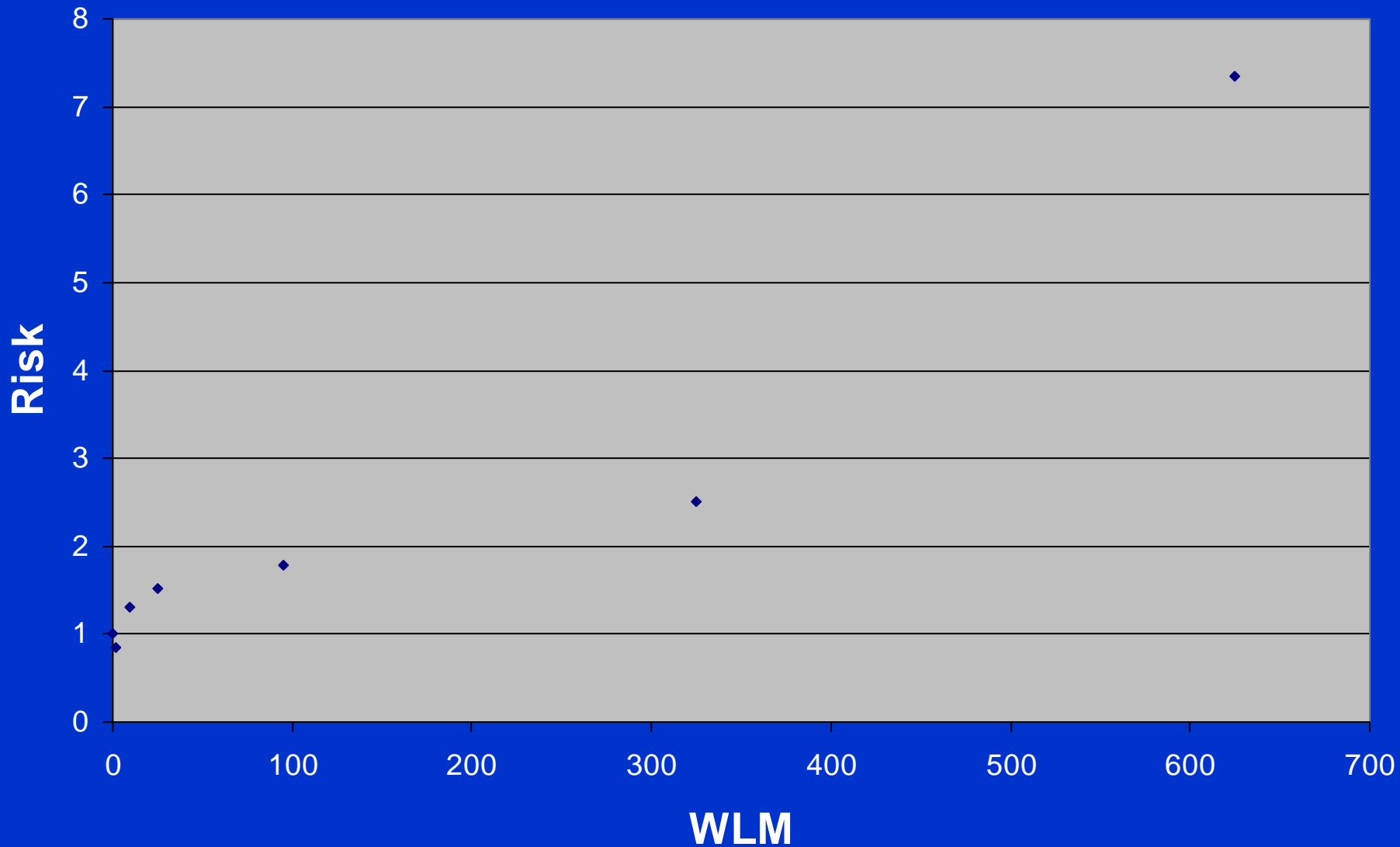
Cancer Incidence

- **Similar pattern to mortality data**
- **Parallel analysis gave similar results**
- **Deaths represented 70% of cases in incidence data**

BEIR VI COMPARISON

- **Data fitted to BEIR VI model**
- **Most BEIR VI parameter estimates fall within the 95% confidence limits for this study**
- **Generally supports the BEIR VI model**

All Males



WLM vs Other Mortality

- **Linear ERR Model fitted to 21 causes of death with >50 deaths**
- **Also fit to leukaemias (34 deaths)**
- **No associations**

Gamma Dose vs Mortality

- Including gamma dose in lung cancer model gave no improvement to fit
- Linear ERR Model fitted to 21 causes of death with >50 deaths
- Also fit to leukaemias (34 deaths)
- No associations

Cancer Incidence Data

- **Model fitted to 9 cancers with >50 cases**
- **Fitted to chronic lymphatic leukaemia (22 cases)**
- **Fitted to all other leukaemias (31 cases)**
- **No associations with WLM**

Gamma Dose vs Incidence

- **Repeated analysis for gamma dose and cancer & leukaemia incidence**
- **No associations**

Other Factors

- **No smoking data available**
- **Potential exposure to other carcinogens at Port Radium**
- **No diesel use at Port Radium**
- **Only limited diesel use at Beaverlodge in last few years**

Future Work

70% of cohort still alive

**Further follow-up in 10-15 years would
be useful**