

HEALTH AND MORTALITY STUDY

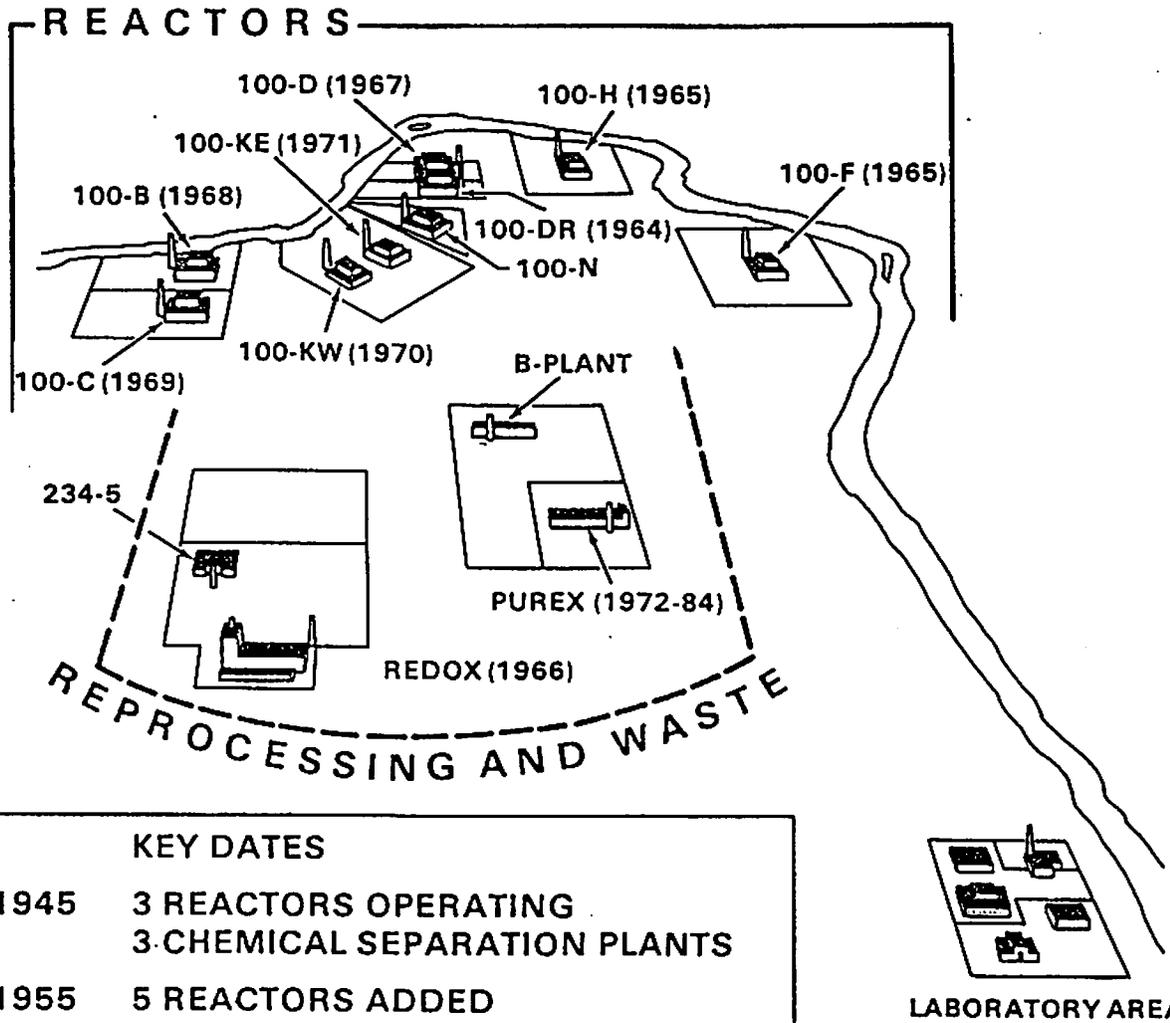
H.E.H.F. ACTIVITIES

- **OPERATIONS EMPLOYEE ROSTER**
- **CONSTRUCTION EMPLOYEE ROSTER**
- **MORTALITY DATA
COLLECTION AND CODING**
- **OCCUPATIONAL INFORMATION**
- **OCCUPATIONAL EXPOSURES
RADIOLOGIC AND OTHER**
- **PERSONAL EXPOSURES
CIGARETTE SMOKING**
- **REPRODUCTIVE OUTCOMES STUDY
DATA COLLECTION AND CODING**

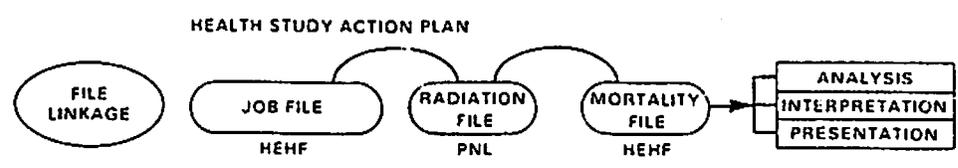
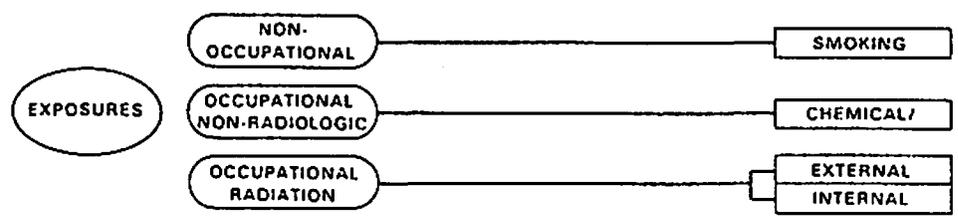
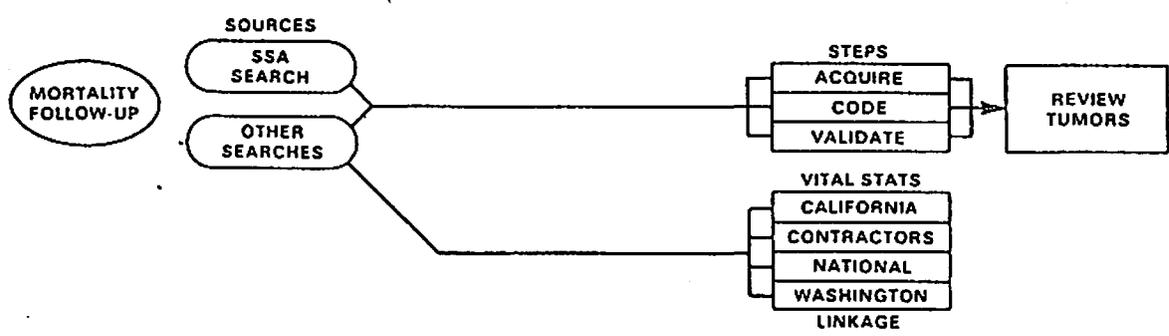
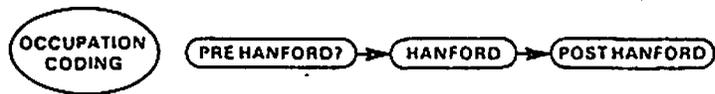
P.N.L. ACTIVITIES

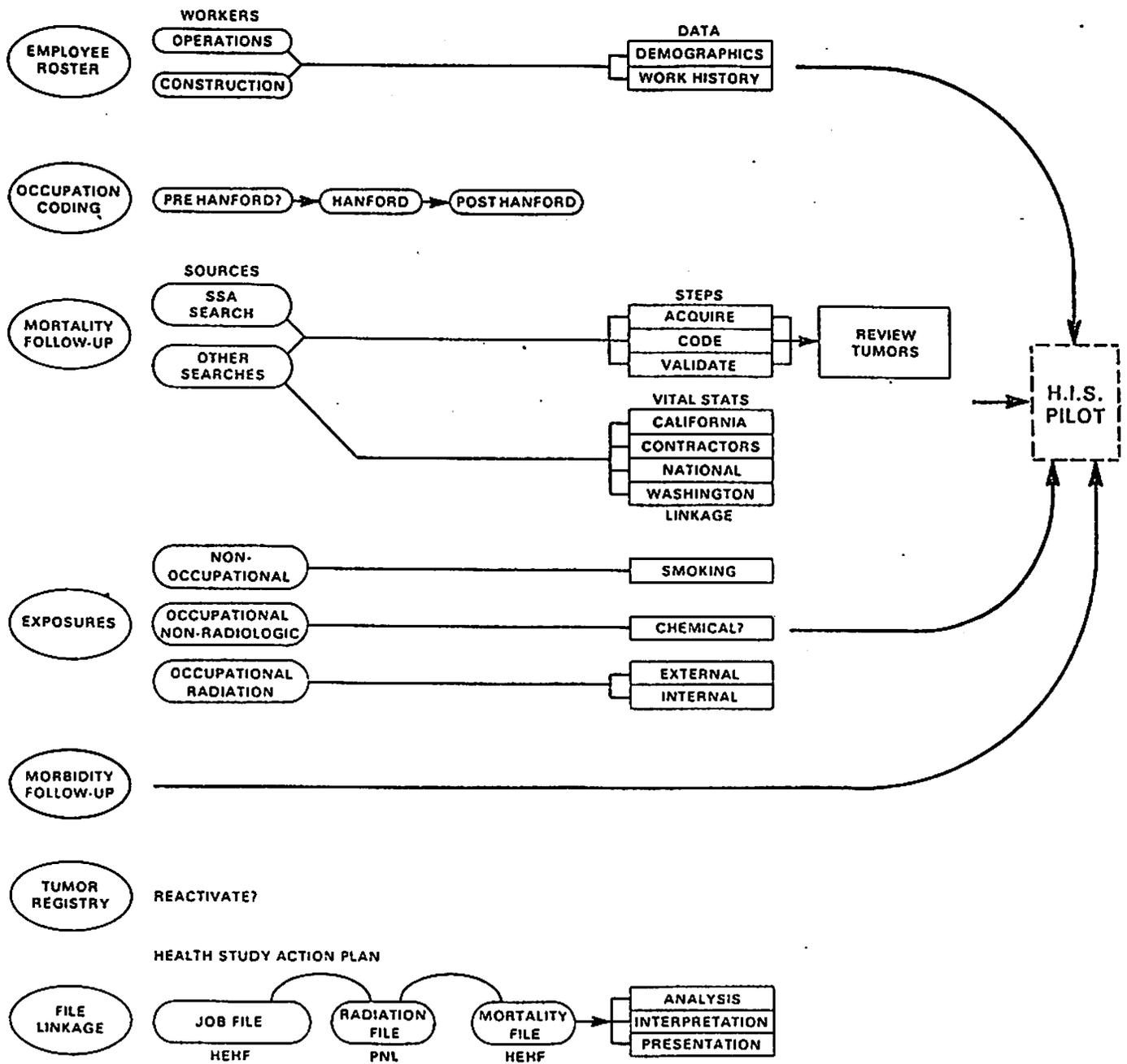
- **THE HANFORD MORTALITY STUDY ANALYSIS**
- **REPRODUCTIVE OUTCOMES STUDY ANALYSIS**

HANFORD SITE



KEY DATES	
1945	3 REACTORS OPERATING 3-CHEMICAL SEPARATION PLANTS
1955	5 REACTORS ADDED 2 FUELS REPROCESSING PLANTS
1956	* HANFORD LABS EXPAND
1963	1 REACTOR ADDED (N)
1972	8 REACTORS CLOSED * FUEL REPROCESSING ON STANDBY
1984	FUEL REPROCESSING ON LINE



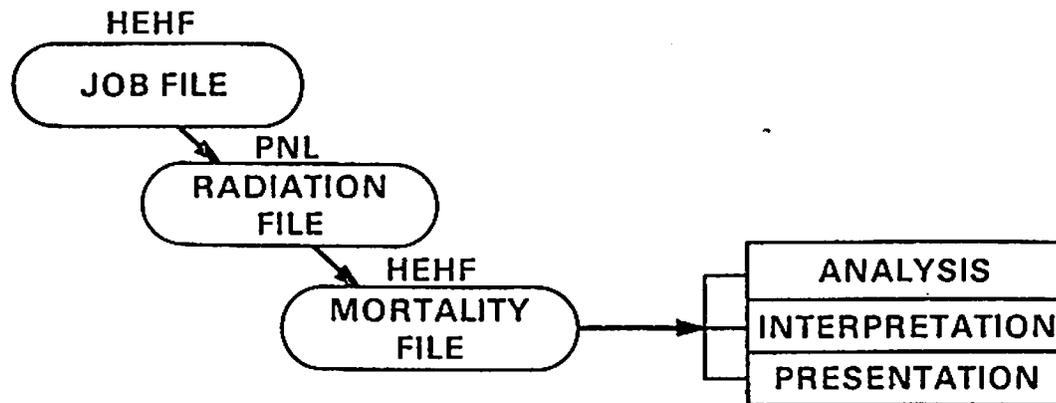


HEALTH AND MORTALITY STUDY

THE OVERALL MORTALITY STUDY

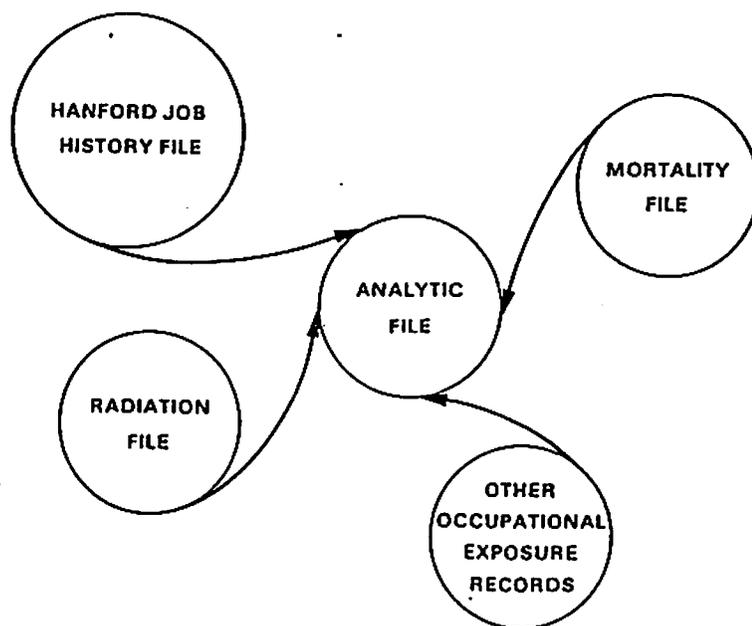
SINGLE PURPOSE / DIVIDED RESPONSIBILITIES

HEALTH STUDY ACTION PLAN

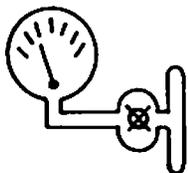


D.O.E. - HANFORD HEALTH AND MORTALITY STUDY

MORTALITY STUDY OF HANFORD WORKERS



HEALTH AND MORTALITY STUDY



OPERATIONS EMPLOYEE ROSTER

- CONTENTS
- MAINTENANCE



CONSTRUCTION EMPLOYEE ROSTER

- CONTENTS
- MAINTENANCE
- TIME TABLE FOR COMPLETION

HEALTH AND MORTALITY STUDY

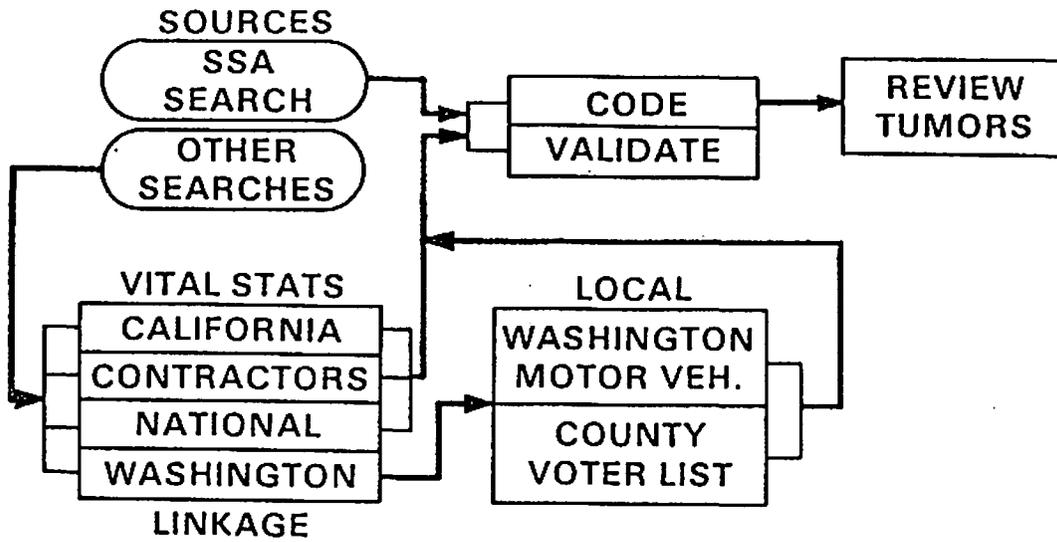
HANFORD EMPLOYEES FEB. 1984

	<u>OPERATIONS</u>	<u>CONSTRUCTION</u>
MALE	40,191 (72%)	12,799 (95%)
FEMALE	15,996 (28%)	656 (5%)
ALL	56,187	13,455
	69,642	

HEALTH AND MORTALITY STUDY

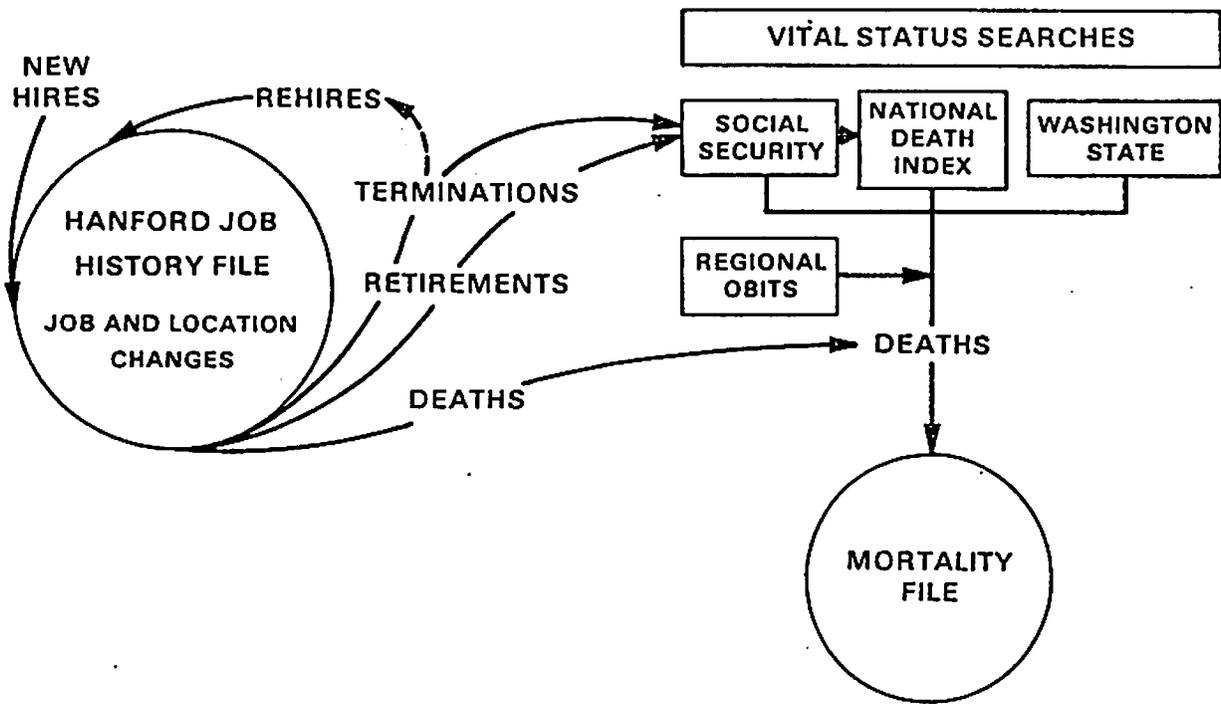
MORTALITY DATA

- CONTENTS
- GROWTH
- ASCERTAINMENT



D.O.E. - HANFORD HEALTH AND MORTALITY STUDY

MORTALITY FILE PRODUCTION



HEALTH AND MORTALITY STUDY

SELECTED CHARACTERISTICS OF THE
MORTALITY FILE

	<u>PERCENT</u>
<u>ROSTER</u>	
OPERATIONS EMPLOYEES	83%
CONSTRUCTION EMPLOYEES	17%
<u>SEX</u>	
MALE	89%
FEMALE	11%
<u>RACE</u>	
WHITE	98%
BLACK	1%
OTHER	1%

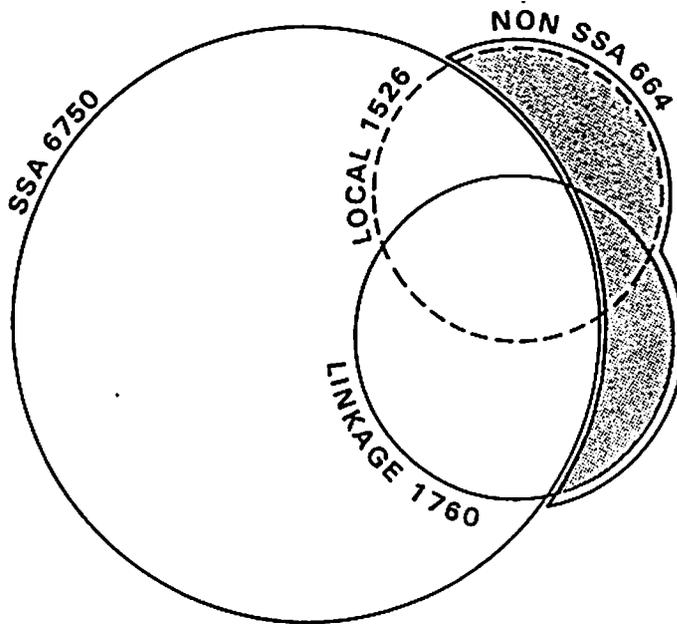
HEALTH AND MORTALITY STUDY

**FIRST SOURCE OF DEATH
NOTIFICATION FOR HANFORD
OPERATIONS AND CONSTRUCTION
WORKERS: 1944-1984**

<u>SOURCE</u>	<u>PERCENT</u>
SOCIAL SECURITY	78%
HEALTH STUDY GROUP	13%
WASHINGTON SURVEILLANCE	4%
NATIONAL DEATH INDEX	3%
CALIFORNIA SURVEILLANCE	2%
ALL	(n=10642)

HANFORD HEALTH AND MORTALITY STUDY

NOTIFICATIONS OF DEATH BY SOURCE FOR HANFORD
OPERATIONS AND CONSTRUCTION WORKERS, MALES:
1944-84



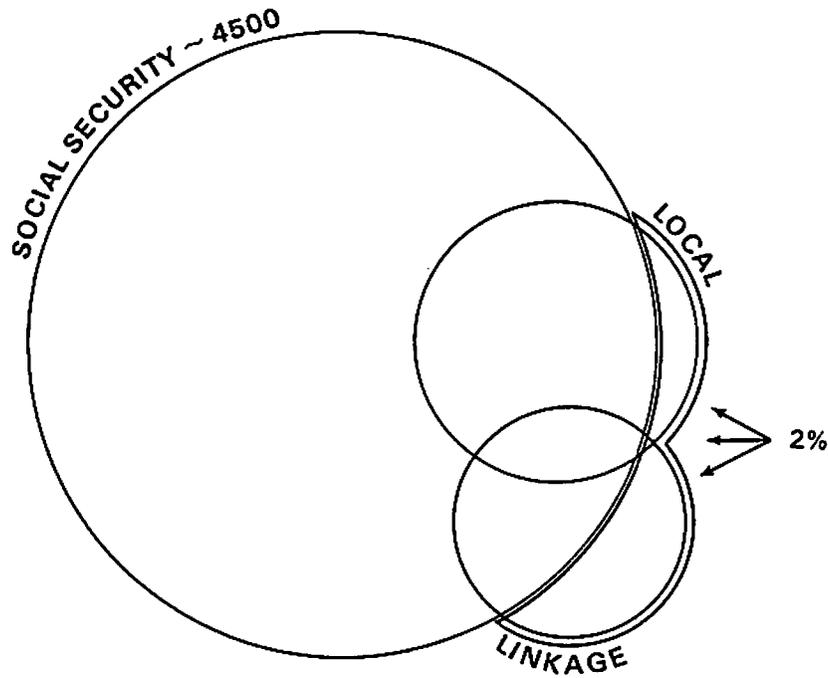
AREA IS PROPORTIONAL TO NUMBER OF DEATHS

LINKAGE = MILHAM, GE, NDI, CAMLIS

LOCAL = HEHF, COUNTY, ETC.

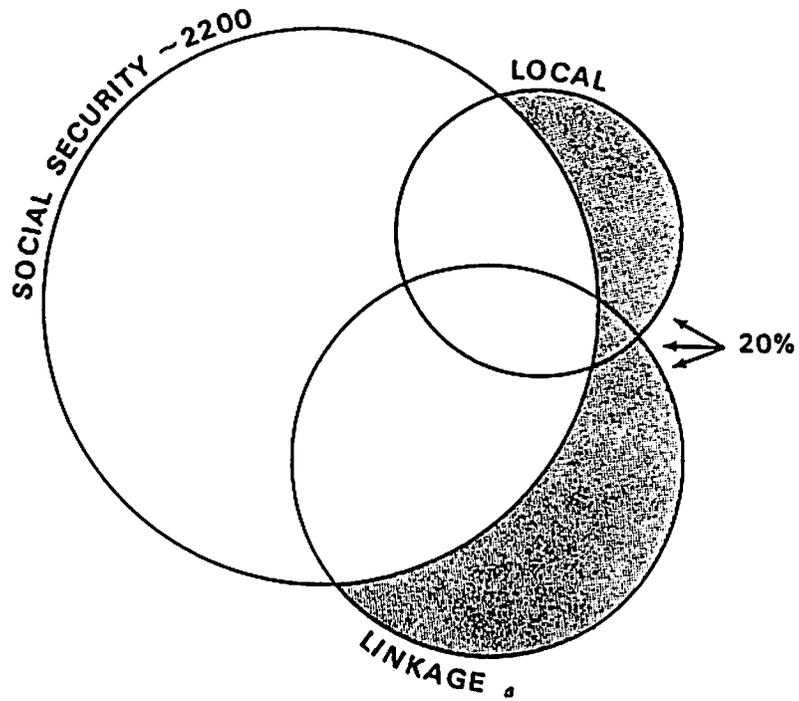
HANFORD HEALTH AND MORTALITY STUDY

NOTIFICATIONS OF DEATH BY SOURCE FOR MALE
OPERATIONS WORKERS 1944-74



HANFORD HEALTH AND MORTALITY STUDY

NOTIFICATIONS OF DEATH BY SOURCE FOR MALE
OPERATIONS WORKERS 1975-83



HEALTH AND MORTALITY STUDY

**TIME FROM SSA NOTIFICATION TO
RECEIPT OF CERTIFICATE**

<u>YEAR OF DEATH</u>	<u>HEHF NOTIFIED</u>	<u>DEATH CERTIFICATES ARRIVE (%)</u>
1978	1Q 1980	1Q 1981 (70%)
1980	1Q 1981	2Q 1982 (60%)

1Q = FIRST QUARTER

HANFORD HEALTH AND MORTALITY STUDY

DEATH CERTIFICATE STATUS ON
FEB. 84 FOR DEATHS ASCERTAINED
THROUGH THE SOCIAL SECURITY
SYSTEM

<u>SENT TO SSA</u>	<u>YEARS COVERED</u>	<u>ALL DEATHS</u>	<u>NO DEATH CERTIFICATE(%)</u>
VARIOUS	1944-1977	5752	2%
1979	1947-1979	1383	5%
1981	1975-1981	667	14%
1983	1952-1983	1490	61%*
	ALL	9292	13%

*30% REPRESENT NEWLY ASCERTAINED
CONSTRUCTION WORKERS DEATHS

HEALTH AND MORTALITY STUDY

**MORTALITY FILE AND DEATH CERTIFICATE
STATUS 1944-1984**

CERTIFICATE ON HAND

	<u>'YES'</u>	<u>'NO'</u>	<u>(% 'NO')</u>	<u>TOTAL</u>
OPERATIONS(1)	7900	669	(8%)	8569
CONSTRUCTION	<u>1542</u>	<u>529</u>	<u>(26%)</u>	<u>2071</u>
TOTAL	9442(2)	1198	(11%)	10640

(1) To avoid double counting, 102 deaths among persons who were both operations and construction workers were included in the operations group

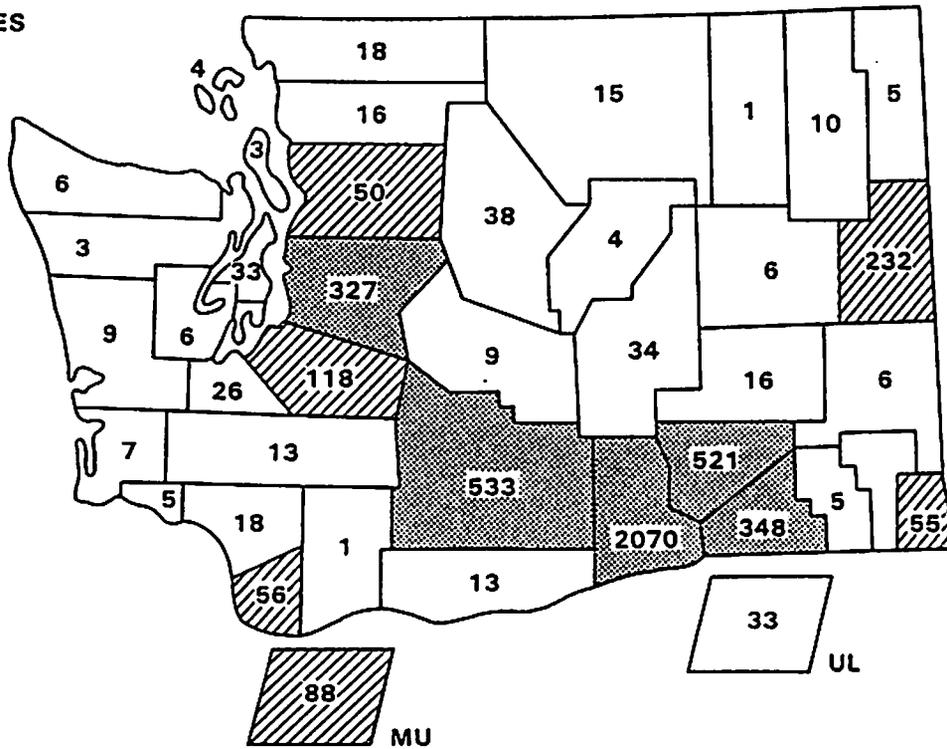
This includes the 9.83 SSA submission (1984)

(2) 8954 have ICD-9 codes; the remainder are being coded

HEALTH AND MORTALITY STUDY

LOCATION OF DEATH FOR FORMER HANFORD EMPLOYEES
WASHINGTON AND OREGON COUNTIES

MALES



HEALTH AND MORTALITY STUDY

**SOURCE OF DEATH NOTIFICATION
FOR HANFORD WORKERS DYING IN
WASHINGTON STATE, 1975-77**

WASHINGTON OCCUPATIONAL
MORTALITY SURVEILLANCE SYSTEM*

SOCIAL
SECURITY

FOUND

NOT FOUND

	FOUND	NOT FOUND	
	13%	77%	90%
	3%	7%	10%
	16%	84%	n=668

*DESIGNED AND MANAGED BY DR. MILHAM

HEALTH AND MORTALITY STUDY

**SOURCE OF DEATH NOTIFICATION
FOR HANFORD WORKERS DYING IN
WASHINGTON STATE, 1978-83**

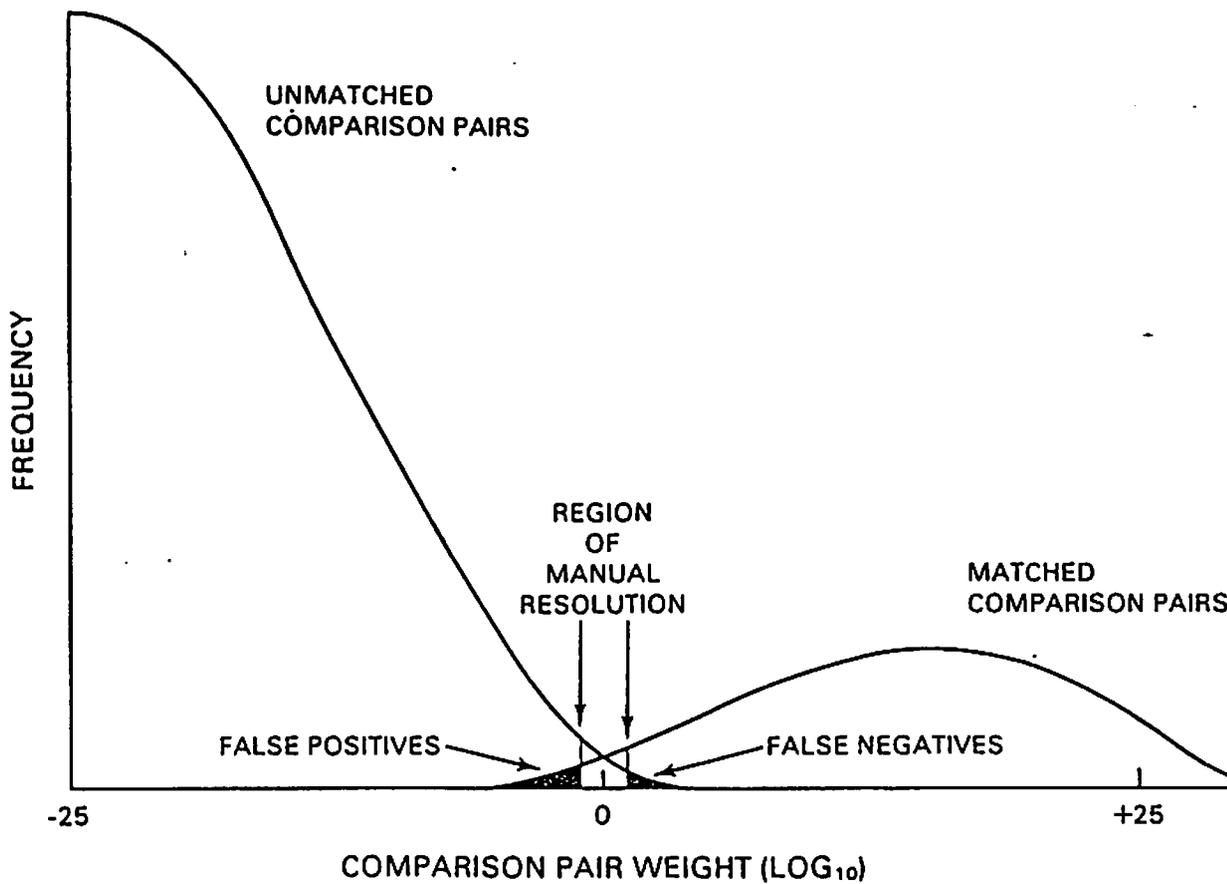
WASHINGTON OCCUPATIONAL
MORTALITY SURVEILLANCE SYSTEM*

SOCIAL
SECURITY

	FOUND	NOT FOUND	
FOUND	9%	37%	46%
NOT FOUND	24%	10%	54%
	33%	67%	n=1446

*DESIGNED AND MANAGED BY DR. MILHAM.
INCLUDES ALL DEATHS SUBMITTED 'TO DATE' BY
DR. MILHAM

HEALTH AND MORTALITY STUDY



HEALTH AND MORTALITY STUDY

**SOURCE OF DEATH NOTIFICATION
FOR HANFORD WORKERS DYING IN
CALIFORNIA 1960-1977**

CALIFORNIA MORTALITY
LINKAGE SYSTEM

SOCIAL
SECURITY*

FOUND

NOT FOUND

	FOUND	NOT FOUND	
	85%	9%	94%
	5%	1%	6%
	90%	10%	n=572

*SSA SEARCHES THROUGH 9.83

HEALTH AND MORTALITY STUDY

**SOURCE OF DEATH NOTIFICATION
FOR HANFORD WORKERS DYING IN
CALIFORNIA 1978-1982**

**CALIFORNIA MORTALITY
LINKAGE SYSTEM**

**SOCIAL *
SECURITY**

FOUND

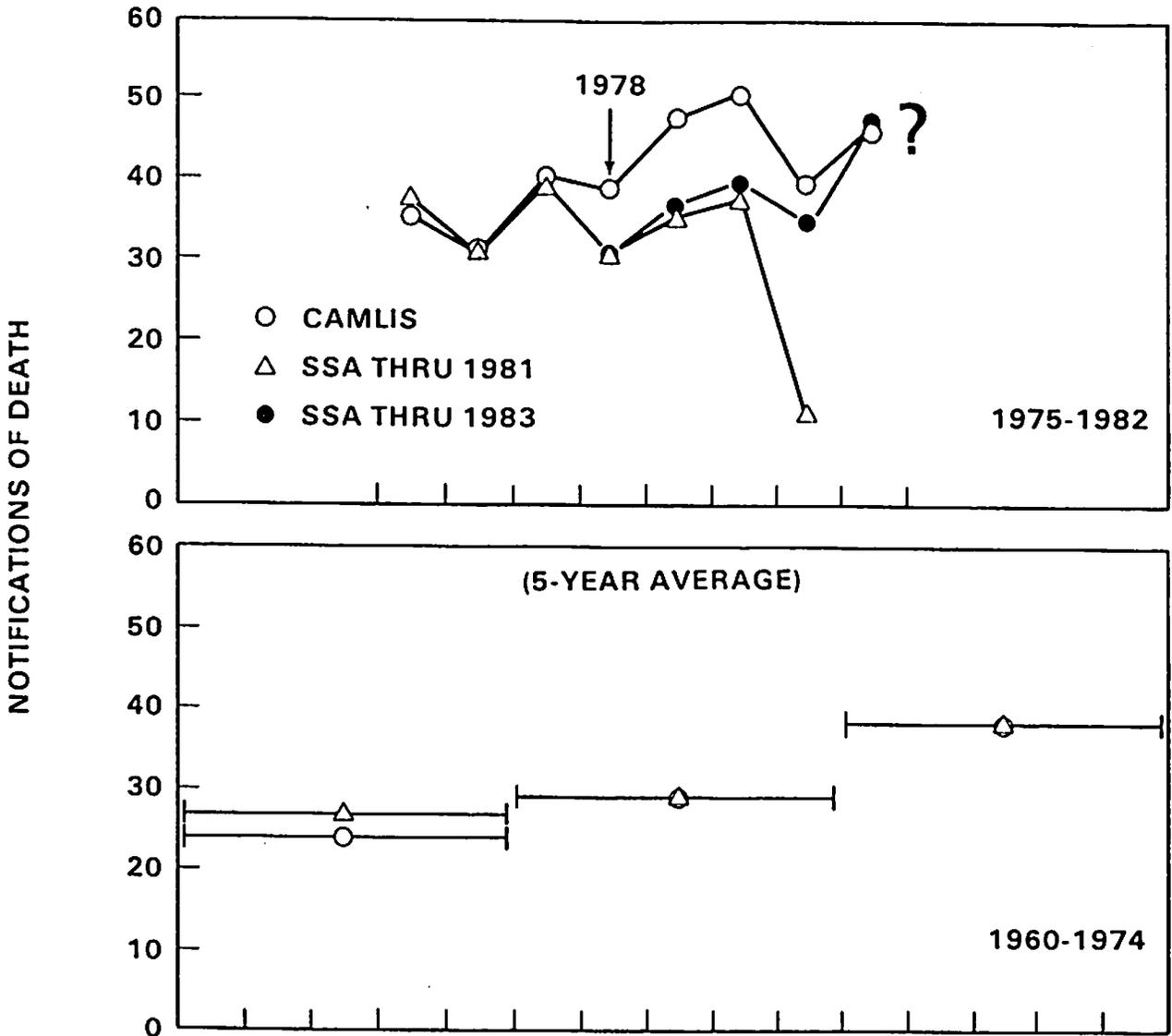
NOT FOUND

	FOUND	NOT FOUND	
	75%	5%	80%
	19%	1%	20%
	94%	6%	n=240

***SSA SEARCHES THROUGH 9.83**

HEALTH AND MORTALITY STUDY

CAMLIS AND SSA ASCERTAINED DEATHS IN CALIFORNIA 1960-1982



HEALTH AND MORTALITY STUDY

**NINETY ONE POTENTIAL SEX CODE ERRORS
IDENTIFIED BY CAMLIS PROCESSING**

<u>CORRECT SEX CODE</u>	<u>HEHF SEX CODE</u>		
	MALE	FEMALE	
MALE	31	11	42
FEMALE	34	15	49
	65	26	91
	FEMALE FIRST NAME	MALE FIRST NAME	

HEALTH AND MORTALITY STUDY

**CRITERIA FOR ORDERING
CERTIFICATES FROM THE NDI
SEARCH**

- SSN AND LAST NAME(EXACT) 89%
- EXACT ON ALL EXCEPT SSN (3.2%)
- SSN AND EXACT ON ALL (EXCEPT
LAST NAME) 11%
- SSN AND SURNAME

AUGUST 16 ,1983

NDI APPLICATION #: 820011

SUMMARY RETRIEVAL STATISTICS

RECORDS ON THE NATIONAL DEATH INDEX FILE:

REQUEST RECORDS SUBMITTED BY THE USER:

YEAR(S) SEARCHED: 1979, 1980, 1981

TOTAL USER REQUEST RECORDS SUBMITTED

47055

TOTAL NDI RECORDS SEARCHED

6,127,206

NO. OF USER RECORDS INVOLVED IN MATCHES

4295

NO. OF NDI RECORDS INVOLVED
IN POSSIBLE RECORD MATCHES

5395

NO. OF NON-MATCHING USER RECORDS

42732

ALL ITEMS MATCHED

581

NO. OF REJECTED USER RECORDS

28

OTHER POSSIBLE MATCHES

4814

NUMBER OF USER REQUEST RECORDS INVOLVED IN MATCHES WITH ONE OR MORE NDI RECORDS

POSSIBLE NDI
RECORD MATCHES

NUMBER OF USER
REQUEST RECORDS

1 NDI RECORD

3561

2 NDI RECORDS

519

3 NDI RECORDS

124

4 NDI RECORDS

62

5 NDI RECORDS

15

6 NDI RECORDS

5

7 NDI RECORDS

3

8 NDI RECORDS

4

9 NDI RECORDS

2

10 NDI RECORDS

0

11+ NDI RECORDS

0

TOTAL USER RECORDS
INVOLVED IN MATCHES

4295

NUMBER OF NDI RECORDS INVOLVED IN POSSIBLE RECORD MATCHES WITH THE USER'S REQUEST RECORDS, BY REGISTRATION AREA OF DEATH

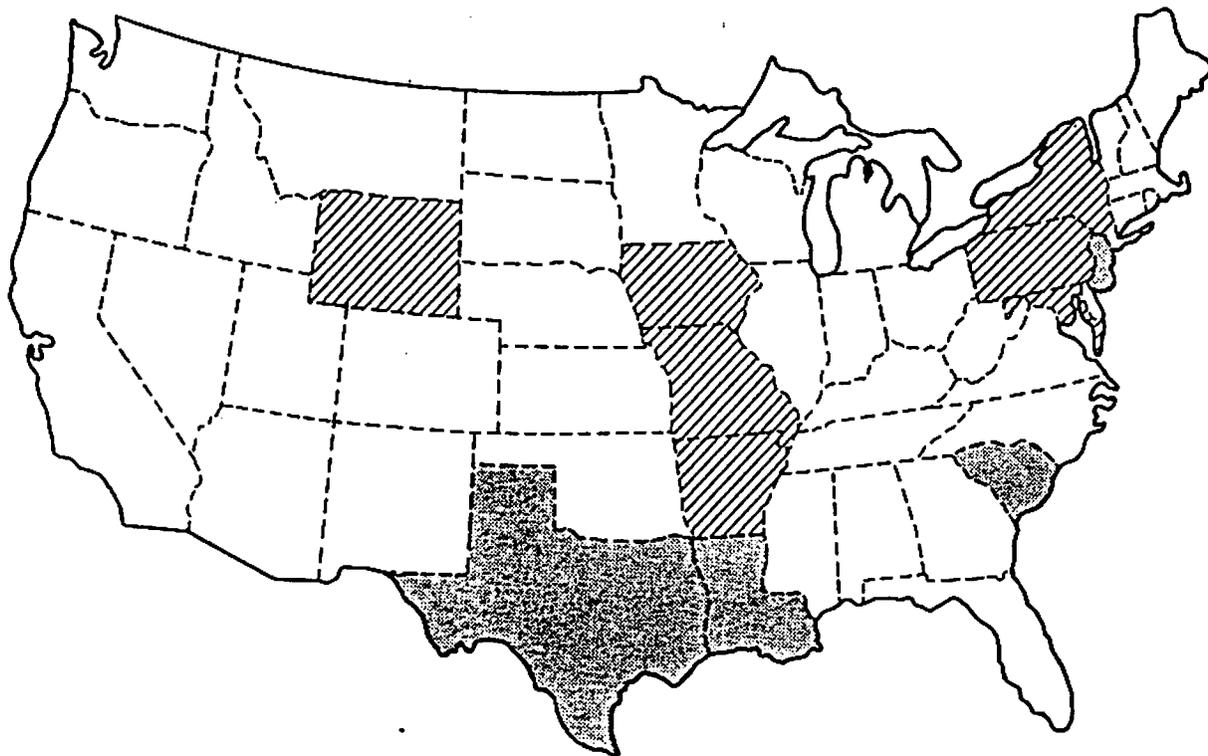
S T A T E S	TOTAL POSSIBLE RECORD MATCHES	MATCHES ON ALL ITEMS PROVIDED*	OTHER POSSIBLE RECORD MATCHES**	S T A T E S	TOTAL POSSIBLE RECORD MATCHES	MATCHES ON ALL ITEMS PROVIDED*	OTHER POSSIBLE RECORD MATCHES**
TOTAL U.S.	5395	581	4814	MISSOURI	133	0	133
				MONTANA	23	0	23
				NEBRASKA	30	0	30
				NEVADA	29	0	29
				NEW HAMPSHIRE	14	0	14
ALABAMA	89	0	89	NEW JERSEY	119	0	119
ALASKA	7	0	7	NEW MEXICO	25	0	25
ARIZONA	78	1	77	NEW YORK	158	0	158
ARKANSAS	77	0	77	NEW YORK CITY	144	0	144
CALIFORNIA	466	3	463	NORTH CAROLINA	132	0	132
COLORADO	72	1	71	NORTH DAKOTA	9	1	8
CONNECTICUT	46	0	46	OHIO	213	0	213
DELAWARE	18	0	18	OKLAHOMA	70	0	70
DIST OF COLUMBIA	28	0	28	OREGON	121	9	112
FLORIDA	229	0	229	PENNSYLVANIA	267	0	267
GEORGIA	132	0	132	RHODE ISLAND	16	0	16
HAWAII	13	0	13	SOUTH CAROLINA	68	0	68
IDAHO	49	4	45	SOUTH DAKOTA	13	0	13
ILLINOIS	190	0	190	TENNESSEE	109	0	109
INDIANA	114	0	114	TEXAS	233	1	232
IOWA	50	0	50	UTAH	32	0	32
KANSAS	40	0	40	VERMONT	13	0	13
KENTUCKY	70	0	70	VIRGINIA	101	1	100
LOUISIANA	78	0	78	WASHINGTON	886	559	327
MAINE	8	0	8	WEST VIRGINIA	44	0	44
MARYLAND	96	0	96	WISCONSIN	63	0	63
MASSACHUSETTS	102	0	102	WYOMING	11	0	11
MICHIGAN	149	0	149	PUERTO RICO	6	0	6
MINNESOTA	62	1	61	VIRGIN ISLANDS	0	0	0
MISSISSIPPI	50	0	50				

* THIS COLUMN INDICATES HOW MANY OF THE 'TOTAL POSSIBLE RECORD MATCHES' RESULTED FROM SITUATIONS WHERE 'ALL' ITEMS PROVIDED ON A USER'S REQUEST RECORD MATCHED WITH ITEMS ON A NDI RECORD.

** THIS COLUMN INDICATES HOW MANY OF THE 'TOTAL POSSIBLE RECORD MATCHES' RESULTED FROM SITUATIONS WHERE 'ONLY SOME' OF THE ITEMS PROVIDED ON A USER'S REQUEST RECORD MATCHED WITH ITEMS ON A NDI RECORD.

HEALTH AND MORTALITY STUDY

NATIONAL DEATH INDEX



PROBLEMS

D/C ORDERED - NEVER RECEIVED

HEALTH AND MORTALITY STUDY

**COMPARISON OF 125 SSA NOTIFICATIONS
WITH NDI REQUESTS: 1979-81 DEATHS**

<u>FEATURE</u>	<u>ESTIMATED OCCURRENCE RATE</u>
MULTIPLE MATCHES	8.0%
DIFFERENT SSN	2.4%
DIFFERENT RACE	1.6%
DIFFERENT BIRTHDATE	14.4%

HEALTH AND MORTALITY STUDY

CHRONOLOGY OF THE ICD-9 RECODING PROJECT

<u>1980</u>		DECISION TO RECODE TO ICD-9
<u>1981</u>	SEP	BEGIN TO ASSEMBLE DEATH CERTIFICATES
<u>1982</u>	FEB	N.C.H.S. CONTACTED
	MAY	REQUEST FOR BIDS TO RECODE
	SEP	BID ACCEPTED
	DEC	ROUND 1 CODING RETURNED
		A.D.P. DESIGN BEGINS
<u>1983</u>	MAY	DATA ENTRY SYSTEM COMPLETED
	JUN	DATA ENTRY BEGINS
	AUG	DATA ENTRY COMPLETE
	*SEP	DATA RECOVERY
	NOV	ROUND 2 CODING RETURNED
	DEC	ICD-9 TO ICD-8 CONVERSION DESIGNED (1)
<u>1984</u>	JAN	DATA TAPE TO N.C.H.S. (10th)
		DATA TAPE RETURNED (25th)
	FEB	PROBLEM SOLVING
	MAR	TAPE READY FOR USE

(1) CONVERSION CODES PROVIDED BY DR. MILHAM

HEALTH AND MORTALITY STUDY

OCCUPATIONAL INFORMATION

- CONTENTS
- SOURCES
- WHAT WE ARE DOING



HEALTH AND MORTALITY STUDY

**STANDARD JOB TITLES WITH THE
WORD FRAGMENT "CHEM"***

ANALYST CHEM

CHEM CONTROL

CHEM HELPER

CHEM OPER

CHEM PROCESS OPER

CHEM RELIEF

CHEM TECH

CHEM TRNE

CLERK CHEM

NUC CHEM OPER

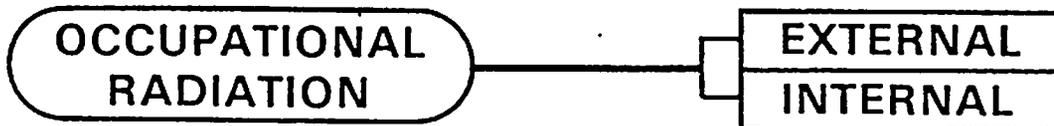
*PARTIAL LIST

HEALTH AND MORTALITY STUDY



RADIOLOGIC EXPOSURES

- BACKGROUND AND MEDICAL EXPOSURE
- POST HANFORD EXPOSURE



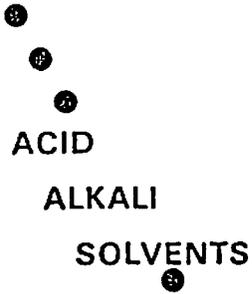
HANFORD HEALTH AND MORTALITY STUDY

POST HANFORD RAD EXPOSURE STUDY

	<u>OPERATIONS DEATHS</u>	<u>POSSIBLE EXTRA EXPOSURE</u>
PANCREAS	102	7
STOMACH	62	3
MYELOMA	14	1
ALL	178	11 (6%)

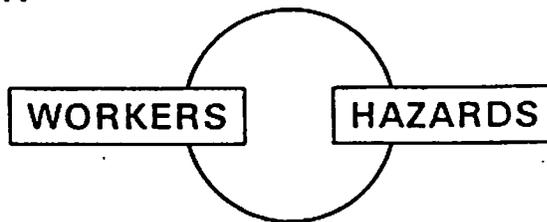
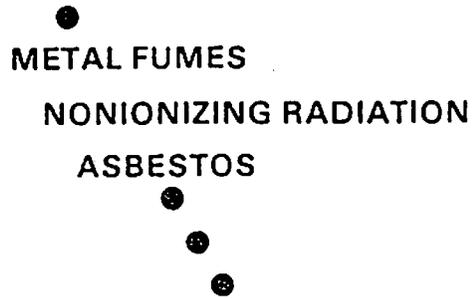
TOTAL 'HITS' IN ALL FILES SEARCHED: 233
FILES SEARCHED: DOE-HQ/INEL, ORAU, NRC

HEALTH AND MORTALITY STUDY

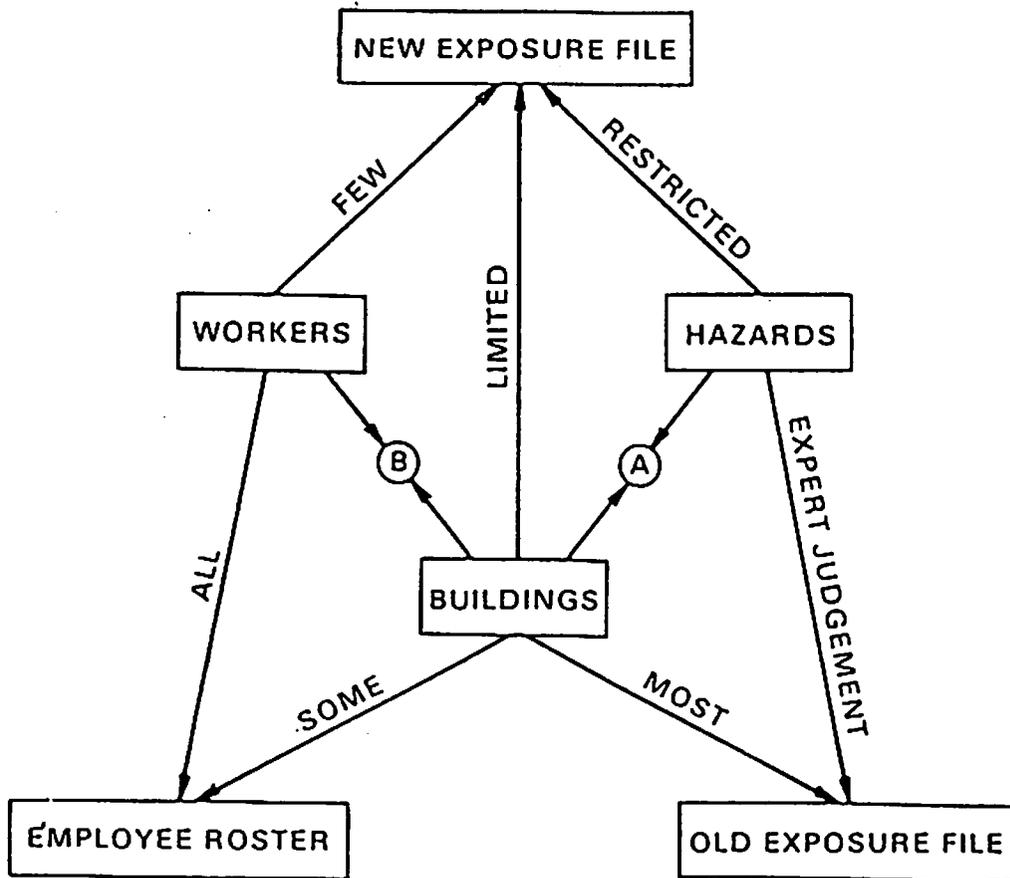


OTHER OCCUPATIONAL EXPOSURES

- WHAT WE KNOW
- HOW WE KNOW IT
- HOW WE USE IT

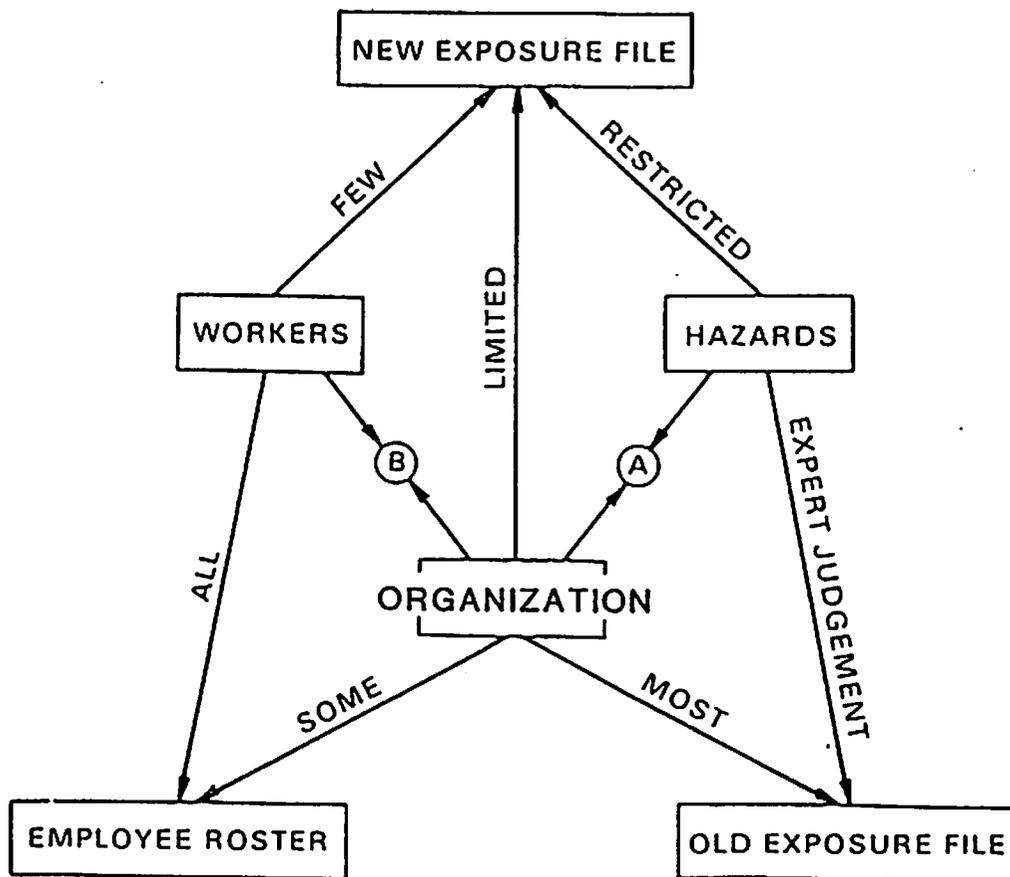


ASSIGNMENT OF EXPOSURES TO WORKERS



B KEY LINK TO ALL NONRADIATION (CHEMICAL) EXPOSURE STUDIES

ASSIGNMENT OF EXPOSURES TO WORKERS - 2



B KEY LINK TO ALL NONRADIATION (CHEMICAL) EXPOSURE STUDIES

HEALTH AND MORTALITY STUDY

HANFORD ORGANIZATIONAL CODE DIRECTORY
1944-1968

HANFORD LABORATORIES - HANFORD ATOMIC PRODUCTS OPERATION G.E. CO.

7546 COOLANT SYSTEMS DEVELOPMENT
7560 PLUTONIUM METALLURGY OPERATION
7561 PLUTONIUM METALLURGY RESEARCH
7562 PLUTONIUM FUELS DEVELOPMENT
7563 PLUTONIUM FABRICATION DEVELOPMENT
7570 PLUTONIUM RECYCLE TEST REACTOR OPERATION

7600 CHEMICAL RESEARCH & DEVELOPMENT OPERATION
7610 CHEMICAL RESEARCH OPERATION
7611 LABORATORY FACILITIES
7612 RADIOLOGICAL CHEMISTRY
7613 CHEMICAL SEPARATIONS
7614 FISSION PRODUCT CHEMISTRY
7616 HEAVY ELEMENT CHEMISTRY
7620 CHEMICAL DEVELOPMENT OPERATION
7622 CHEMICAL ENGINEERING DEVELOPMENT
7623 PROCESS EQUIPMENT DEVELOPMENT
7624 PROCESS CONTROL DEVELOPMENT
7625 DEVELOPMENT & CORROSION CHEMISTRY

AYRES, J.A.
WICK, O.J.
STEWART, R.W.
THOMAS, I.D.

NELSON, JR., T.C.

MILLER, J.H.M.

REAS, W.H.
WALLING, M.T.
BERRETH, E.A.
NIELSEN, J.M.
(NO LISTING)
MOORE, R.L.
VOILAND, E.E.

HILL, O.F.

PLATT, A.M.
SWIFT, W.H.
ALKIRE, G.J.

BURNS, R.E.

HEALTH AND MORTALITY STUDY

ORG CODES FROM PHONE BOOK

7H20 BIOLOGY & CHEMISTRY DEPARTMENT

MANAGER,

HARVEY DRUCKER 331/1..... 376-5662

SECRETARY,

THEODORA M. (THEO) CUSHING 331/3..... 376-3010

ASSOCIATE MANAGER,

JAMES F. PARK 331/9..... 376-3375

SECRETARY,

PATRICIA M. BRESINA 331/7..... 376-0100

ASSOCIATE MANAGER,

MURLIN F. GILLIS 331/27..... 376-8256

SECRETARY,

DIANE A. ROWE 331/25..... 376-8306

COORDINATOR, NUCLEAR PROGRAM,

ROY C. THOMPSON, JR 331/5..... 376-3043

SECRETARY,

PATRICIA M. BRESINA 331/7..... 376-0100

COORDINATOR, CHEMISTRY,

ROGER E. SCHIRMER LSL/1517 375-2915

7H21 FACILITIES & OPERATIONS SECTION

MANAGER,

RAYMOND F. (RAY) HULTMAN 331/4..... 376-3045

SECRETARY,

GERTRUDE G. HAGGARD 331/6..... 376-0107

HEALTH AND MORTALITY STUDY

ORG CODES FROM PHONE BOOK (CONT)

7H22 ANIMAL RESOURCES CENTER SECTION

MANAGER,

V. GLENN HORSTMAN 331/11A 376-3069

SECRETARY,

DAPLYN MATZINGER 331/11..... 376-0260

7H25 DEVELOPMENT TOXICOLOGY SECTION

MANAGER,

BRUCE J. KELMAN 331/45..... 376-5685

SECRETARY,

DEBRA L. (DEBBIE) BONDURANT 331/44..... 376-5685

7H26 CELL BIOLOGY SECTION

MANAGER,

RICHARD P. SCHNEIDER 331/68..... 376-5097

SECRETARY,

BETTY A. ANDRESEN 331/66..... 376-0403

7H27 INHALATION TECHNOLOGY &
TOXICOLOGY SECTION

MANAGER,

MANUEL T. KARAGIANES LSL/1105 375-3648

SECRETARY,

BARBARA J. COLE LSL/1103 375-2011

HEALTH AND MORTALITY STUDY

•
•
AVOCATIONS
ALCOHOL

PERSONAL EXPOSURES - SMOKING

DRUGS
DIET

- NATURE OF OUR CONCERN
- BACKGROUND
- WHAT WE ARE DOING

HEALTH AND MORTALITY STUDY

ASBESTOS COHORT IDENTIFICATION SCHEME FOR THE
OHH CONSTRUCTION WORKER FILE

<u>JOB TITLES</u>	<u>CORRESPONDING PAYROLL # PREFIX</u>	<u>CORRESPONDING ASBESTOS WORKER GROUP</u>
ASBESTOS WORKER	49	}
INSULATOR	49	
PIPECOVERER	49	
BOILERMAKER	50	GROUP 2
PIPEFITTER	06	}
STEAMFITTER	06	
WELDERFITTER	06	
PLUMBER	06	

HEALTH AND MORTALITY STUDY

ASBESTOS COHORT IDENTIFICATION SCHEME
FOR THE OHH OPERATIONS WORKER FILE

JOB TITLE WORD FRAGMENTS

GROUP 1

ASBESTOS	MECH INSULATION	PIPECOVER MECH
ASBESTOS APPRENT	INSULATOR	PIPECOVERER HELPER
ASBESTOS MECH	FOREMAN INSULATOR	PIPECOVERER JRN
ASBESTOS WKR	INSULATOR JRN	PIPECOVERER TRNE
ASBESTOS WKR JRN	PIPECOVER	
INSULATION	PIPECOVERER	

GROUP 2

BOILER	BLMKR	BOILERMAKER MECH
BOILER FOREMAN	BOILERMAKER APPREN	BOILERMAKER TRNE
BOILER OPER	BOILERMAKER FOREMN	WELDER BOILERMAKER
BOILERMAKER	BOILERMAKER JRN	

HEALTH AND MORTALITY STUDY

ASBESTOS COHORT IDENTIFICATION SCHEME FOR THE
OHH OPERATIONS WORKER FILE

JOB TITLE WORD FRAGMENTS - (CONT)

GROUP 3

PIPEFITTER	PLUMBR FITR APPRENT	STEAMFITTER MECH
PIPEFTR	PLMBR FITR JRN	STEAMFITTER PLBR
PIPEFITTER APPRENT	PLUMBR FITR TRNE	STEAMFITTER PLBR J
PIPEFITTER INST	PLMBR FOREMAN	STEAMFITTER TRNE
PIPEFITTER JRN	PLMBR JRN	STEAMFITTER WLDR
PIPEFITTER MECH	PLMBR PIPEFITTER	STEAMFITTER WLDR A
PIPEFITTER TRNE	PLMBR STFTR JRN	STEAMFITTER WLDR J
PLMBR PIPEFITTER	PLMBR STMFTR APPR	STMFTR
WELDER PIPEFITTER	PLMBR STMFTR JRN	STMFTR PIPEFTR JRN
STMFTR PIPEFITR JRN	PLMBR STMFTR TRNE	WELDER STMFTR
PLUMBER	WELDER PLMBR	WELDER STMFTR HELP
PLMBR	WELDER PLMBR FTR	WELDER STMFTR JRN
PLUMBER MECH	WELDER PLMBR FTR J	WELDER STMFTR TRNE
WELDER JRN PLUMBER	STEAM	WELDER BLMKR JRN
PLBR	STEAMFITTER	WELDER FITTER
PLMB	STEAMFITTER APPREN	WELDER PLMBR
STEAMFITTER PLBR	STEAMFITTER FOREMN	WELDER PLMBR FTR
STEAMFITTER PLBR J	STEAMFITTER HELPER	WELDER PLMBR FTR J
PLMBR APPR	STEAMFITTER INST	
PLMBR FITR	STEAMFITTER JRN	

HEALTH AND MORTALITY STUDY

**FORMULAS USED FOR CALCULATING
PROPORTIONATE MORTALITY
RATIOS (PMR) AND CANCER
PROPORTIONATE MORTALITY
RATIOS (CPMR)**

$$\text{PMR} = \frac{\text{\# OF DEATHS FROM A SPECIFIC CAUSE/TIME}}{\text{TOTAL \# OF DEATHS/TIME}}$$

$$\text{CPMR} = \frac{\text{\# OF DEATHS FROM A SPECIFIC CANCER/TIME}}{\text{TOTAL \# OF CANCER DEATHS/TIME}}$$

FROM	TO	Job Description	Code	Company
1632	1036	FARMER		SELF EMPLOYED
1036	237	RECLAMATION		CIVILIAN CONSERVATION COR
237	339	FARMER		SELF EMPLOYED
339	939	HARVEST		FARM WORKER
939	1039	PACKING PLANT		H. M. CHASE CO
1140	241	APPRENTICE WELDER		GOVAN WELDING SHOP
641	741	PACIKER		WALLA WALLA CANNING CO
246	646	ANN HANDLER		UMATI LLA ORDNANCE DEPOT
146		LABORER		S. A. MOORE & CO
946		LABORER		HENRY GEORGE & SONS
946	247	WELDER		MATER MACHINE WORKS
946		FINISHER HELPER		ASBURY TRANSPORTATION CO
1046		TRUCK DRIVER		CORVALLIS FUEL CO
1046	647	LABORER		US ARMY ENGINEERS
647	747	CLERK		H. HALVEIRSON CONTRACTORS
847		LABORER		MCCORMICK CONSTRUCTION CO
847	947	LABORER		BEEBE CONSTRUCTION CO
947	148	SR CLERK		ATKINSON & JONES CON CO
148	57	OPERATOR		GENERAL ELECTRIC CO
19		METAL WORKER		
51		UTILITY OPERATOR		
54	63	PILE OPERATOR		
63	70	NUCLEAR REACTOR CONT OPERATOR		

CREATION OF OLD EXPOSURE FILE (HEX)

Severity Code 1-10 (10% - 100%)

Percent of work week the substance was encountered.

Created from lists of materials, the dates they were encountered, the buildings they were used in. Also used extensive interviews with supervisors of craft workers, exempt and non-bargaining workers.

Buildings (1967)

In 1967 there were 1057 buildings existing at Hanford. Only 277 were considered to be useful in evaluating exposures [Ref. to Exhibit 7].

Buildings in the past were not inventoried.

Source: Notes from 1969 tape recording by EHS presented at Oak Ridge in May, 1969.