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# **RADIOACTIVE WASTE: SOURCES & CHARACTERISTICS**

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**Prepared For:**

**AMERICAN SOCIETY of  
MECHANICAL ENGINEERS**

**1991 RADWASTE SHORT COURSE**

**May 6, 1991**

**Analytical Resources, Inc.  
Engineering Resources, Inc.**



## RADWASTE SOURCES AND CHARACTERISTICS

FROM:

"RADWASTE GENERATION SURVEY UPDATE"  
EPRI NP-5526

PUBLISHED FEBRUARY 1988  
1987-88 VOLUMES UPDATED JANUARY 1989  
1989 VOLUMES UPDATED JANUARY 1990

REPRESENTS MORE THAN 90% OF OPERATING  
UNITS DURING RESPECTIVE PERIODS

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## LOW-LEVEL WASTE STREAMS

- DRY ACTIVE WASTE
- WET PROCESS WASTES
- MISC./ATYPICAL WASTES  
- SG, IN REFUELING POOLS

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## DRY ACTIVE WASTE COMPOSITION

### • COMPACTED WASTE

MATERIALS COMPRESSED FOR VR VIA DRUM OR  
BOX COMPACTION (ON-SITE OR OFF-SITE)

TYPICALLY CONSISTS OF PLASTIC, PAPER, PVC,  
ABSORBENTS, CLOTH, SMALL NON-COMPACTIBLES, ETC.

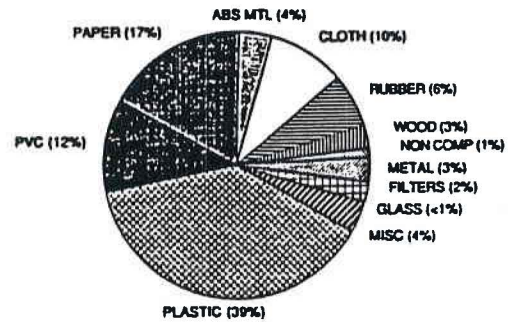
### • NONCOMPACTED WASTE

MATERIAL NOT TYPICALLY COMPACTED PRIOR TO  
DISPOSAL

TYPICALLY CONSISTS OF WOOD, PIPES, VALVES, TOOLS,  
DIRT, CONCRETE, CONDUIT, FILTERS, ETC.

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1988-1989  
COMPACTED WASTE COMPOSITION  
PWR: PLANT AVERAGE

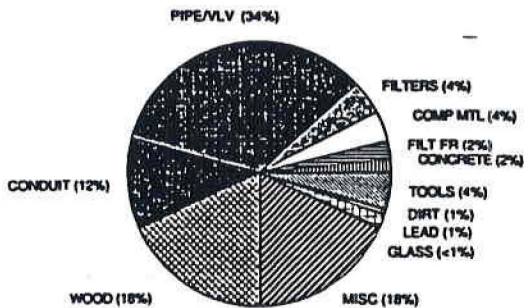


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\* SOURCE REDUCTION

1988-1989

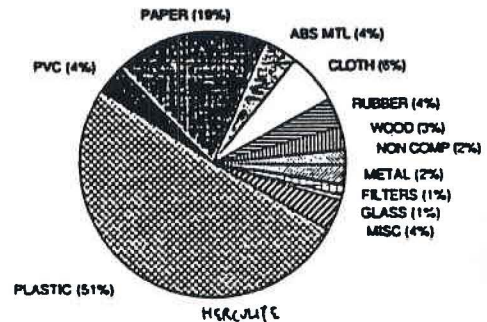
NONCOMPACTED WASTE COMPOSITION  
PWR: PLANT AVERAGE



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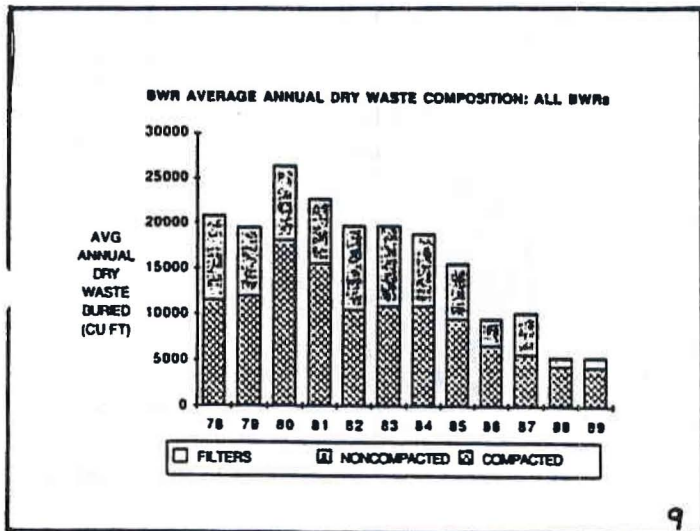
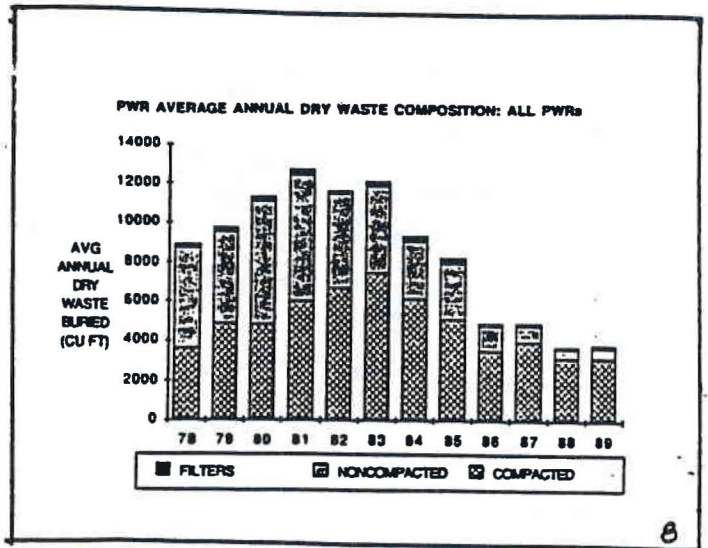
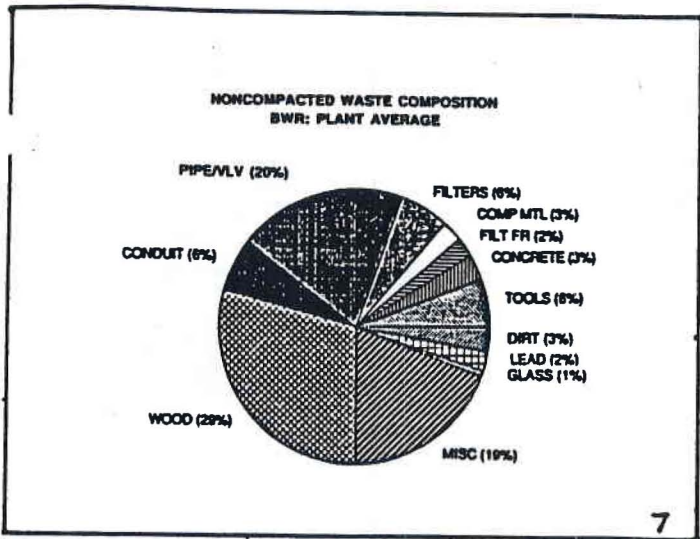
\* CAN BE DECONTAMINATED

COMPACTED WASTE COMPOSITION  
BWR: PLANT AVERAGE



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\* SHIPPED, BY VOLUME

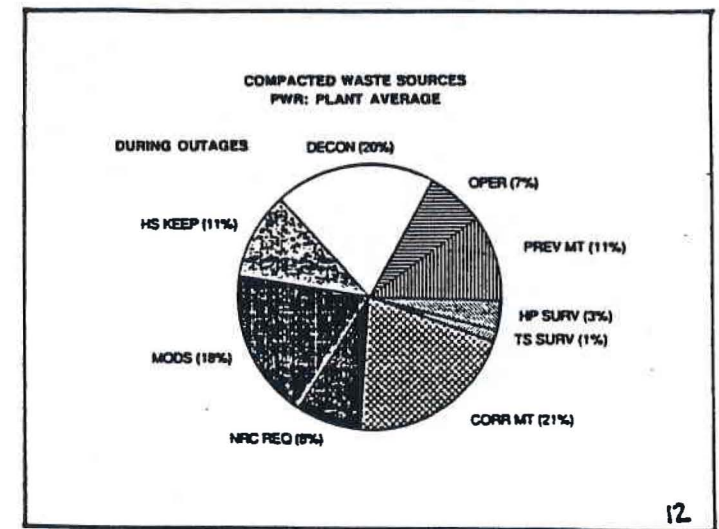
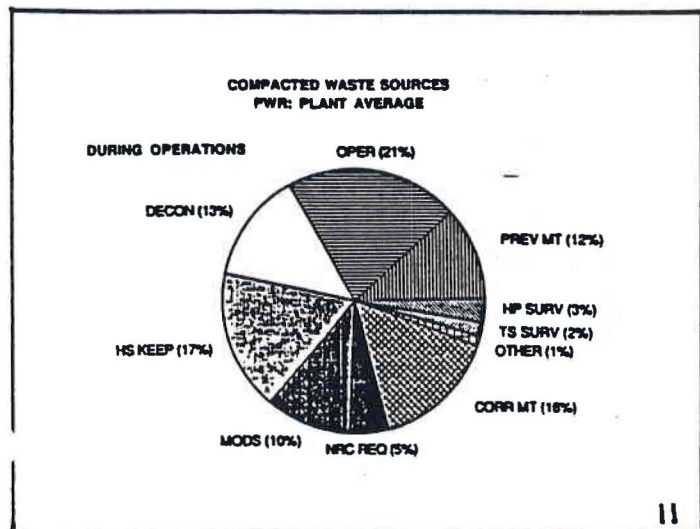


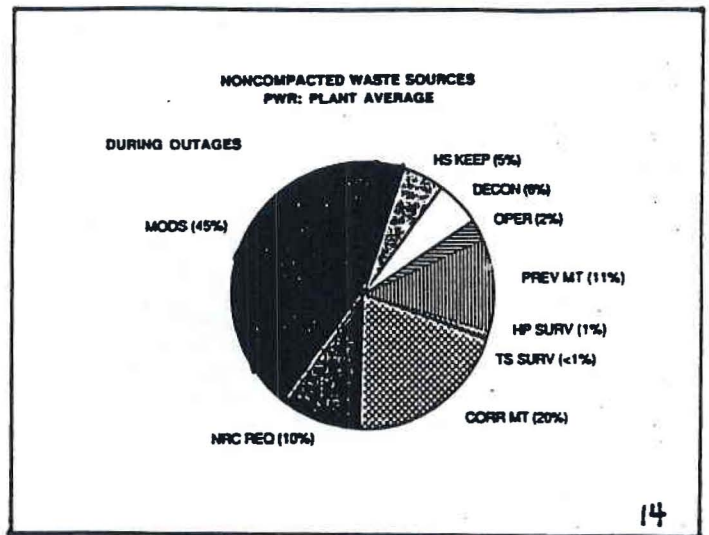
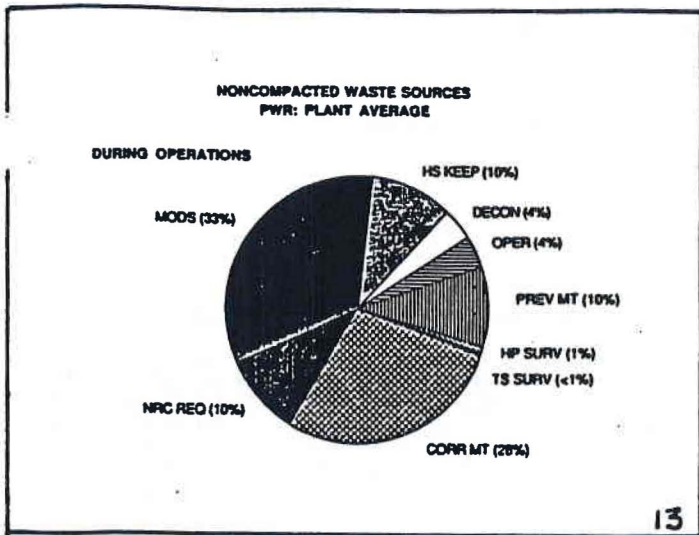
**DRY WASTE SOURCES**

- NORMAL OPERATIONS
- OUTAGE CONDITIONS

**GENERATION TYPICALLY 3 - 4 TIMES  
GREATER DURING OUTAGE CONDITIONS**

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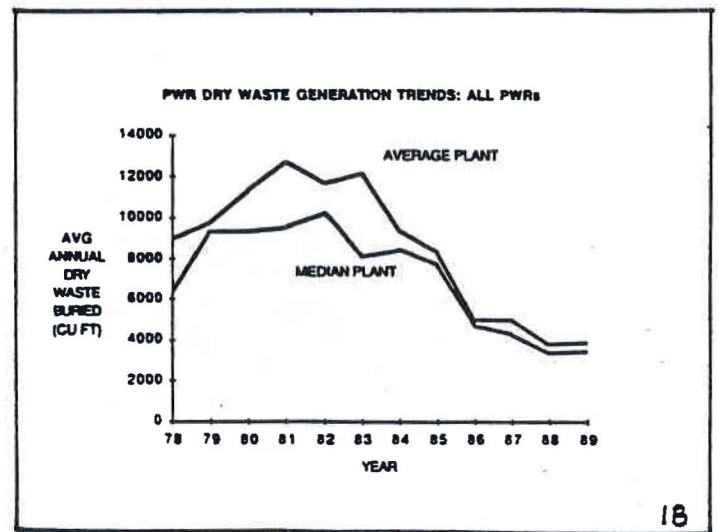
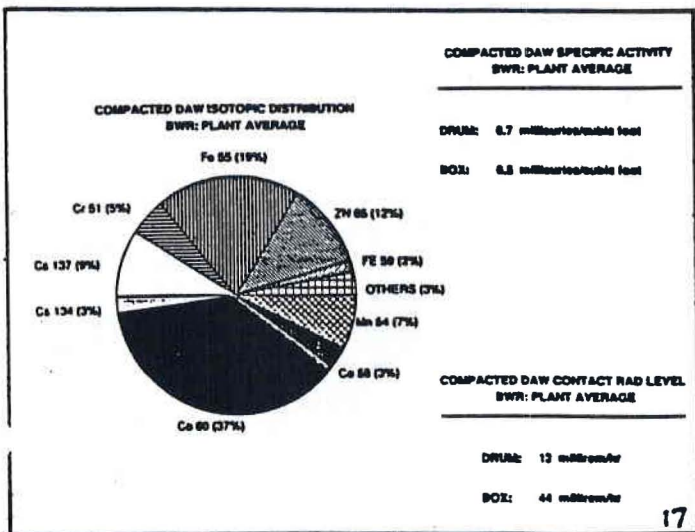
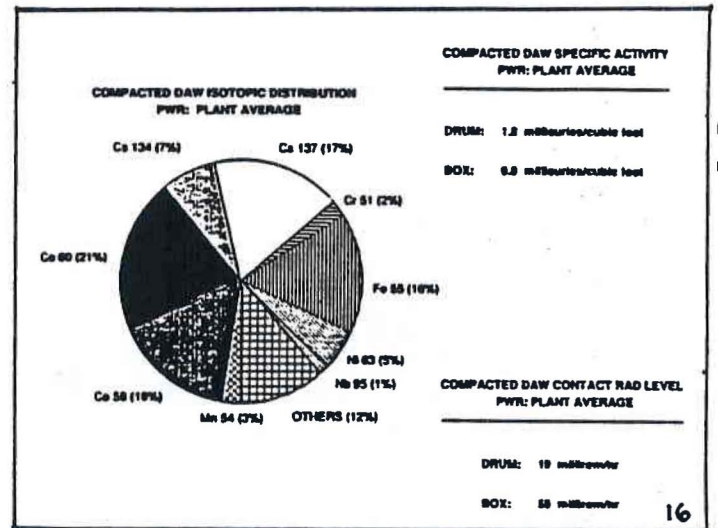


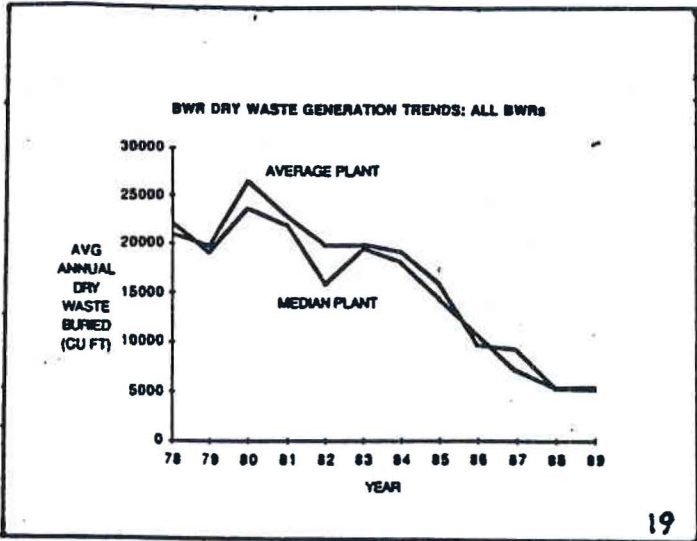


### DRY WASTE CHARACTERISTICS

- COMPACTED DAW
- AVG ISOTOPIC DISTRIBUTION
- AVG SPECIFIC ACTIVITY
- AVG CONTACT RADIATION LEVEL

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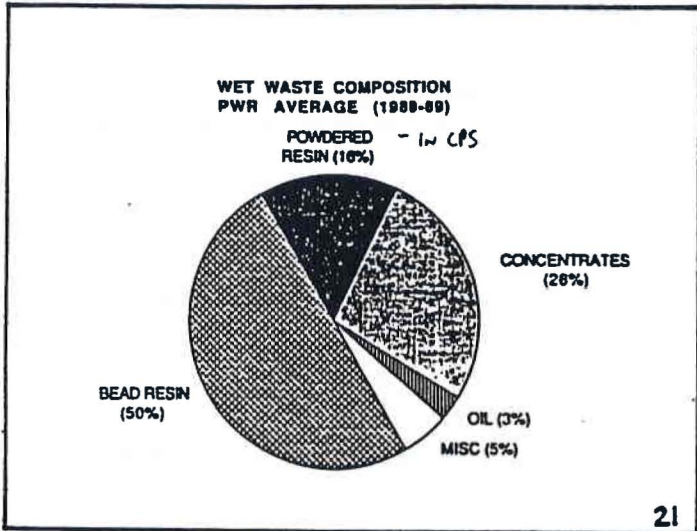


**WET WASTE COMPOSITION**

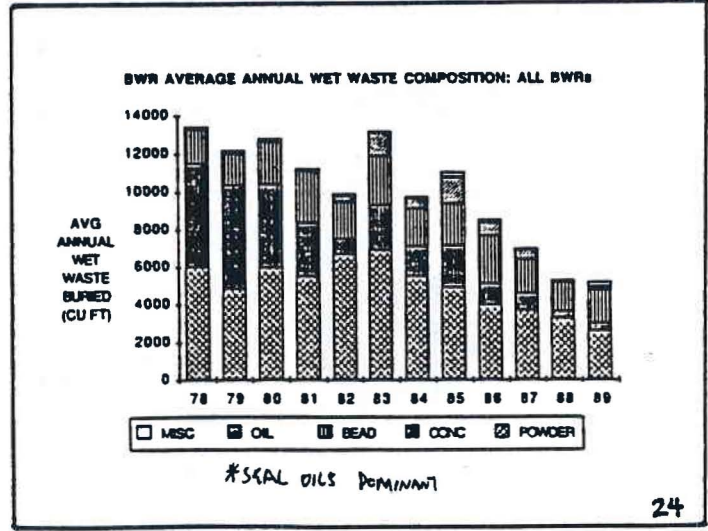
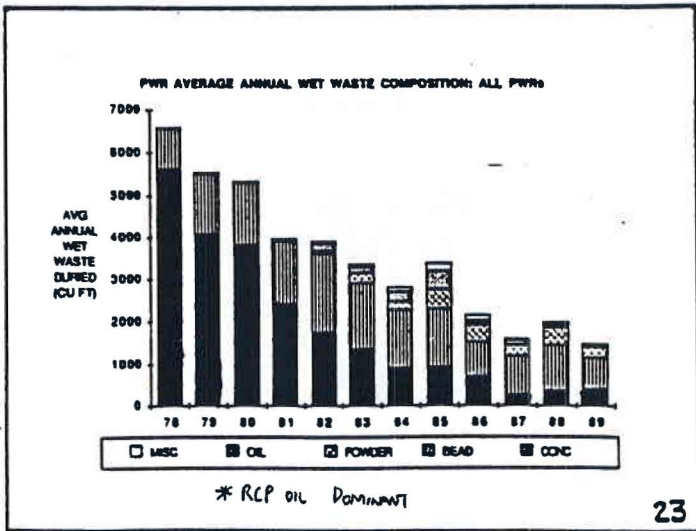
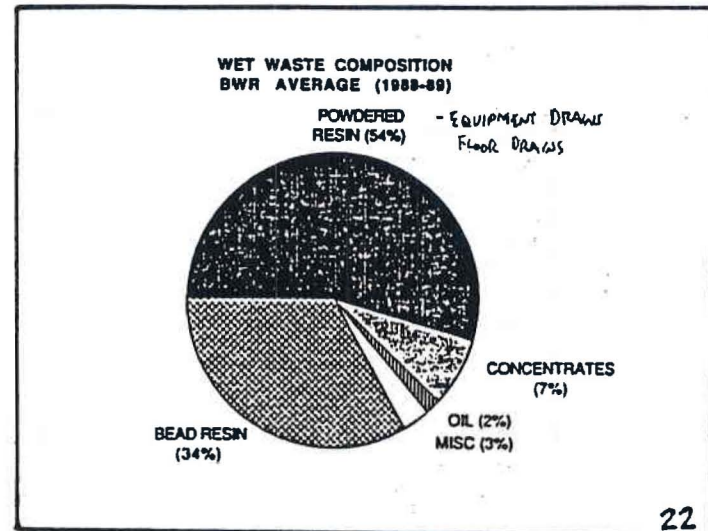
**WASTES FROM LIQUID PROCESSING**

- BEAD RESIN
- POWDERED RESIN / SLUDGES
- EVAPORATOR CONCENTRATES
- MISC WET WASTES

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\* CPS : PRIMARY-TO-SECONDARY LEAKS



## WET WASTE SOURCES

### LIQUID PROCESSING SYSTEMS

#### BWRs

- REACTOR WATER CLEAN-UP
- CONDENSATE POLISHING
- SPENT FUEL POOL COOLING
- RADWASTE
  - HIGH PURITY (EQUIP DRAINS)
  - LOW PURITY (FLOOR DRAINS)
  - CHEMICAL (DECON, REGEN SOLN)
  - DETERGENT (LAUNDRY)

#### PWRs

- REACTOR COOLANT *CULS LEADPOWS*
- CONDENSATE POLISHING
- SPENT FUEL POOL COOLING
- BORON RECOVERY
- STEAM GENERATOR BLOWDOWN
- RADWASTE
  - MISC WASTE (FLOOR & EQUIP DRAINS)
  - CHEMICAL (DECON SOLN, REGEN SOLN)
  - DETERGENT (LAUNDRY)

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### PWR WET WASTE SOURCES

PROCESSING SYSTEM	BEAD RESIN	POWDERED RESIN/SLUDGE	EVAPORATOR CONCENTRATES
REACTOR COOLANT SYSTEM	17%	<i>* HIGH SPECIFIC ACTIVITY</i>	
CONDENSATE POLISHING	20%	67%	
SPENT FUEL POOL COOLING	4%		
BORON RECOVERY	3%		
STEAM GENERATOR BLOWDOWN	4%		
LIQUID RADWASTE	52%		47%
CHEM WASTES			1%
OTHER		13%	52%
TOTAL %	100%	100%	100%

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### BWR WET WASTE SOURCES

PROCESSING SYSTEM	BEAD RESIN	POWDERED RESIN/SLUDGE	EVAPORATOR CONCENTRATES
REACTOR WATER CLEAN-UP	6%	7%	
CONDENSATE POLISHING	39%	41%	
SPENT FUEL POOL COOLING	3%	2%	
LIQUID RADWASTE	52%	50%	83%
CHEM WASTES			15%
OTHER			2%
TOTAL %	100%	100%	100%

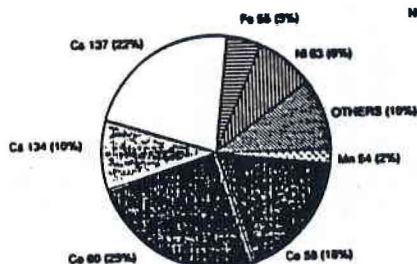
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## WET WASTE CHARACTERISTICS

- BWR - POWDERED RESIN SLUDGE
- PWR - BEAD RESIN
- AVG ISOTOPIC DISTRIBUTION
- AVG SPECIFIC ACTIVITY
- AVG CONTACT RADIATION LEVEL

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### BEAD RESIN ISOTOPIC DISTRIBUTION PWR: PLANT AVERAGE



### BEAD RESIN SPECIFIC ACTIVITY PWR: PLANT AVERAGE

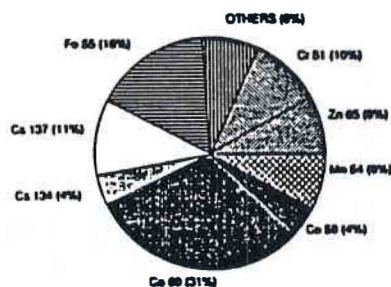
PRIMARY: 1.88 Curies/Cu Ft  
NON-PRIMARY: 0.86 Curies/Cu Ft

### BEAD RESIN CONTACT RAD LEVEL PWR: PLANT AVERAGE

PRIMARY: 54.5 R/W  
NON-PRIMARY: 2.2 R/W

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### POWDERED RESIN SLUDGE ISOTOPIC DISTRIBUTION BWR: PLANT AVERAGE



### POWDERED RESIN SLUDGE SPECIFIC AL. BWR: PLANT AVERAGE

PRIMARY: 1.8 Curies/Cu Ft  
NON-PRIMARY: 0.2 Curies/Cu Ft

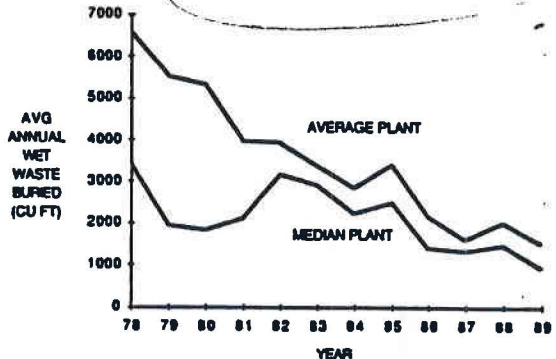
### POWDERED RESIN SLUDGE CNT RAD LEVEL BWR: PLANT AVERAGE

PRIMARY: 42.2 R/W  
NON-PRIMARY: 2 R/W

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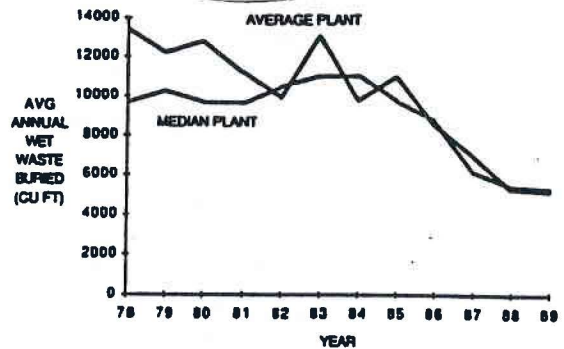
*Disposal*

PWR WET WASTE GENERATION TRENDS: ALL PWRs



*Disposal*

BWR WET WASTE GENERATION TRENDS: ALL BWRs



**TYPICAL PLANT WASTE VOLUMES**

**BWR & PWR DISPOSAL VOLUMES**

- ANNUAL AVERAGES
- PER UNIT BASIS
- AVERAGE PLANT
- MEDIAN PLANT
- BY WASTE STREAM

PWR TYPICAL PLANT WASTE SUMMARY  
Disposal Volume in Cubic Feet per Unit

WASTE	1985-86 AVERAGE (MP-5526)	1987 AVERAGE	1988 AVERAGE	1989 AVERAGE	1988-89 AVERAGE
<b>AVERAGE DRY WASTE</b>					
Compacted	4,300	3,950	3,150	3,150	3,100
Uncompacted	2,100	950	300	350	500
Filters	200	150	100	150	100
<b>TOTAL DRY WASTE</b>	<b>6,600</b>	<b>4,950</b>	<b>3,750</b>	<b>3,850</b>	<b>3,700</b>
<b>AVERAGE WET WASTE</b>					
Dead Resin	1,100	950	1,100	750	950
Powdered Resin/Sludge	400	250	400	250	500
Concentrates	800	250	350	400	500
Oils	300	100	50	50	100
Miscellaneous	150	50	100	50	100
<b>TOTAL WET WASTE</b>	<b>2,750</b>	<b>1,600</b>	<b>2,000</b>	<b>1,500</b>	<b>1,900</b>
<b>AVERAGE TOTAL WASTE</b>	<b>9,350</b>	<b>6,550</b>	<b>5,750</b>	<b>5,350</b>	<b>5,600</b>
<b>MEDIAN DRY WASTE</b>	<b>6,150</b>	<b>4,250</b>	<b>3,300</b>	<b>3,450</b>	<b>3,550</b>
<b>MEDIAN WET WASTE</b>	<b>1,900</b>	<b>1,200</b>	<b>1,450</b>	<b>900</b>	<b>1,100</b>
<b>MEDIAN TOTAL WASTE</b>	<b>8,050</b>	<b>5,450</b>	<b>4,750</b>	<b>4,350</b>	<b>4,650</b>

All volumes are rounded to nearest 50 cubic feet.

BWR TYPICAL PLANT WASTE SUMMARY  
Disposal Volume in Cubic Feet per Unit

WASTE	1985-86 AVERAGE (MP-5526)	1987 AVERAGE	1988 AVERAGE	1989 AVERAGE	1988-89 AVERAGE
<b>AVERAGE DRY WASTE</b>					
Compacted	7,850	5,650	4,350	4,250	4,500
Uncompacted	4,900	3,450	950	1,850	1,100
Filters	50	0	50	150	100
<b>TOTAL DRY WASTE</b>	<b>12,800</b>	<b>9,100</b>	<b>5,350</b>	<b>6,250</b>	<b>5,700</b>
<b>AVERAGE WET WASTE</b>					
Dead Resin	2,400	1,800	1,500	1,750	1,800
Powdered Resin/Sludge	4,350	3,650	3,200	2,550	2,900
Concentrates	1,700	900	400	400	500
Oils	1,100	550	50	300	100
Miscellaneous	200	50	100	250	150
<b>TOTAL WET WASTE</b>	<b>9,750</b>	<b>6,950</b>	<b>5,250</b>	<b>5,150</b>	<b>5,300</b>
<b>AVERAGE TOTAL WASTE</b>	<b>22,550</b>	<b>16,050</b>	<b>10,600</b>	<b>11,400</b>	<b>11,000</b>
<b>MEDIAN DRY WASTE</b>	<b>12,400</b>	<b>7,000</b>	<b>5,200</b>	<b>5,100</b>	<b>4,750</b>
<b>MEDIAN WET WASTE</b>	<b>9,250</b>	<b>6,150</b>	<b>5,400</b>	<b>5,300</b>	<b>5,300</b>
<b>MEDIAN TOTAL WASTE</b>	<b>21,650</b>	<b>13,150</b>	<b>10,600</b>	<b>10,400</b>	<b>10,050</b>

All volumes are rounded to nearest 50 cubic feet.

**INDUSTRY RADWASTE TRENDS**

**BWR & PWR DISPOSAL VOLUMES**

- 1978 THROUGH 1989
- AVG CU FT PER UNIT-YEAR
- TOTAL WASTE - AVG / MEDIAN PLANT

*This is disposal trend not as "generated"*

