Y-12

Y/DZ-512

OAK RIDGE
Y-12
PLANT

MARTIN MARIETTA

WASTE MINIMIZATION AND SUBSTITUTION PROJECT FOR THE Y-12 PLANT, 1973-1994

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MANAGED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

1605

WASTE MINIMIZATION AND SUBSTITUTION PROJECTS FOR THE Y-12 PLANT 1973 TO 1994

PREPARED BY

J.M. NAPIER

SEPT.,1989

1973- DEVELOPMENT STAFF WORKING ON WASTE PROJECTS FOR THE Y-12 PLANT

J.M. NAPIER - GROUP LEADER
I.W. JETER - WTO
P.A. TAYLOR - X-10 CHEM TECH WASTE
F.E. CLARK - RETIRED
H.C. FRANCKE - RETIRED
L.G. OVERHOLSER - RETIRED

1973-1978 MINIMIZATION AND SUBSTITUTION EFFORTS

8 PROJECTS COMPLETED FOR THE Y-12 PLANT

- RECYCLE OF NITRIC ACID
- RECYCLE OF ALUMINUM NITRATE
- SUBSTITUTION OF CHROMIUM IN COOLING TOWERS
- REDUCED NUMBER OF MACHINE COOLANTS
- EXTENDED LIFE OF ACID PICKLE BATHS
- MINIMIZED DEPLETED U RELEASE TO POPLAR CREEK
- MINIMIZED HF USAGE
- SHIPPED SODIUM HYPOCHLORITE TO KNOXVILLE SEWAGE PLANT

1973-1978 - NITRIC ACID RECYCLE

- RECYCLE 99.9% OF THE NITRIC ACID FROM THE WASTE CONDENSATE WITH A NEW PROCESS
- RECYCLED ACID AND REDUCED PURCHASE BY 30 % ABOUT 600,000 LB. OF HNO_3 PER YEAR

1973-1978 - ALUMINUM NITRATE RECYCLE

- RECYCLED ALUMINUM NITRATE - REDUCED

  PURCHASE OF NITRIC ACID (600,000 LB/YR)
  AND ALUMINUM TRIHYDRATE (40,000 LB/YR)

- DEVELOPED AND INSTALLED BIODENITRIFICATION PROCESS FOR WASTE FROM THE RECYCLE OPERATION

1973-1978 - COOLING TOWERS

- SUBSITUTED NON-HAZARDOUS INHIBITOR FOR CHROMIUM IN COOLING TOWER
- ELIMINATED CHROMIUM IN Y-12 COOLING TOWERS
- REDUCED CHROMIUM DISCHARGE TO POPLAR CREEK

  BEFORE - 0.2 PPM IN CREEK (EST. 3500 LB/YR)
  AFTER - LESS THAN 0.02 PPM (EST. 35 LB.YR)

1973-1978 - MACHINE COOLANTS

- REDUCED NUMBER OF MACHINE COOLANTS FOR NON-URANIUM AND DEPLETED METAL MACHINE OPERATIONS - NO REDUCTION IN AMOUNTS
- ELEVEN TYPES OF COOLANTS WERE REDUCED TO 4 TYPES
- ELIMINATED COOLANTS THAT CONTAINED POTENTIAL CARCINOGENS (NITROSOAMINES)

1973-1978 - ACID PICKLE BATH

- EXTENDED LIFE FROM A NOMINAL MONTH TO 6 OR MORE MONTHS BY CHANGING PROCEDURE
- REDUCED DISCHARGE TO S-3 PONDS BY AN ESTIMATED 5000 GAL/YR OF CONCENTRATED NITRIC ACID (EST. 15,000 LB OF NITRATE)

1973 – 1978 REDUCED DEPLETED URANIUM RELEASES TO CREEK

- IDENTIFIED MAJOR DISCHARGES OF DEPLETED U TO THE CREEK
- REDUCED DISCHARGE TO CREEK BY 76 % (EST. 2700 LB/YR DEPLETED U REDUCED TO LESS THAN 700 LB/YR)
- CONCENTRATION IN THE CREEK WATER HAS DECREASED FROM A NOMINAL 0.15 MG/L TO LESS THAN 0.04 MG/L

1973 - 1978 MINIMIZED HF USAGE

- ADDED MONITOR AND CHANGED PROCESS PROCEDURE
- INSTALLED WATER MONITOR ON HF EXHAUST FROM FLUID BEDS
- HF FLOWS STOPPED WHEN WATER CONTENT WAS 10 PPM
- REDUCED HF FLOWS TO AIR BY ESTIMATED 25,000 LB/YR
- INCREASED PRODUCTION YIELDS

1983-1988 HYDROCHLORIC ACID

- METAL PREP IS A MAJOR USER
- MAIN PLATING SHOP ALSO A USER
- PURCHASES DECREASED, BUT WILL INCREASE IN 1989 (LITHIUM CHEMISTRY WAS DOWN ABOUT 1,000,000 LBS/YR)

1973 - 1978 SUMMARY

- REDUCED NITRIC ACID - EST. 1,200,000 LB/YR
- REDUCED ALUMINUM TRIHYDRATE EST. 40,000 LB/YR
- ELIMINATED CHROMIUM EST. 3500 LB/YR
- REDUCED DEPLETED U DISCHARGE EST. 2000 LB/YR
- REDUCED HF RELEASED TO AIR EST. 25,000 LB/YR
- ELIMINATED NEED FOR PROCESSING FACILITY FOR SODIUM HYPOCHLORITE

1978 – WASTE PROCESS GROUP ESTABLISHED IN Y-12 DEVELOPMENT DIVISION

STAFF MEMBERS --

J.M. NAPIER - GROUP LEADER
R.M. (BOB) DAVIS - WTO
I.W. (IVER) JETER - WTO
P.A. TAYLOR - CHEM TECH WASTE
M. (MIKE) TRAVAGLINI - DOE ENVIRONMENTAL
E.G. (MIKE) LAGGIS - RETIRED
R. (RUDY) PALUZELLE - RETIRED

1978–1983 MINIMIZATION AND SUBSTITUTION EFFORTS

- PREPARED LONG RANGE PLAN FOR WASTE DEVELOPMENT - 1979
- INSTALLED RECYCLE SYSTEM FOR MACHINE COOLANT IN NON-URANIUM SHOP
- INSTALLED RECYCLE SYSTEM FOR ECM COOLANT
- NEW COOLANT SUBSTITUTED FOR ABRASIVE SAW
- DEVELOPED TREATMENT SYSTEM CHEMICAL WASTE

1978-1983 - RECYCLE OF MACHINE COOLANT FOR NON-URANIUM SHOP

- PURCHASES OF NEW COOLANT (GENERAL MACHINE SHOP) REDUCED BY ABOUT 66 % (ABOUT 2000 GAL OF CONCENTRATED TRIMSOL)

- DISPOSAL/TREATMENT OF SPENT COOLANT WAS REDUCED BY ABOUT 90,000 GAL/YR (COOLANT-3% TRIMSOL 97 % WATER)

1978 – 1983 RECYCLE OF ECM COOLANT

- INSTALLED RECYCLE SYSTEM FOR ECM COOLANT (SODIUM NITRATE)
- ELIMINATED PURCHASE OF ABOUT 50% OF SODIUM NITRATE (EST. 24,000 LB/YR)
- ELIMINATED TREATMENT/DISPOSAL COST OF COOLANT

1978–1983 – NEW COOLANT SUBSTITUTED FOR ABRASISE SAW

- 100 PPM MORPHOLINE IN WATER USED IN PLACE OF 3 % ORGANIC IN WATER (TRIMSOL)
- RECYCLED NEW COOLANT
- ELIMINATED ESTIMATED 100,000 GAL/YR DISPOSAL OF COOLANT
- REDUCED PURCHASE OF TRIMSOL CONCENTRATE (ABOUT 3000 GAL/YR OF TRIMSOL PLUS 97,000 GAL/YR OF WATER)

1979-1983 - SUMMARY

- REDUCED PURCHASE OF TRIMSOL CONCENTRATE (EST. 5000 GAL/YR)
- REDUCED DISPOSAL/TREATMENT OF EST. 190,000 GAL/YR OF SPENT COOLANT (3 % TRIMSOL 97% WATER)
- REDUCED PURCHASE OF EST. 24,000 LB/YR OF SODIUM NITRATE
- ELIMINATED TREATMENT/DISPOSAL OF 24,000 LB/YR OF SODIUM NITRATE

1983–1988 MINIMIZATION AND SUBSTITUTION EFFORTS

J.M. NAPIER - GROUP LEADER
J.E. CLINE
G.D. HACKETT
C.W. HANCHER
B.C. PADGETT
K.F. SIMON
G.E. HARRIS
M.E. JOHNSON
H.E. DEVANEY - TRANSFERRED FROM MP
Y.C. CHILDS - TRANSFERRED FROM HSEA
C.A. WASHINGTON - ON LOAN TO HSEA
M.B. SAUNDERS - SAFETY ASSESSMENTS

1983–1988 – MINIMIZATION AND SUBSTITUTION EFFORTS

- PURCHASE OF CHEMICALS REDUCED FROM NOMINAL 8.4 MILLION LB/YR TO 5 MILLION LB/YR
- 20% DECREASE IN PRODUCTION WORK LOAD HAS OCCURED
- PURCHASE COSTS WERE ESTIMATED TO AVERAGE $0.40/LB ($ 2 MILLION) AND DISPOAL COST WERE ESTIMATED AT $ 4.00/LB ($20 MILLION)
- MANY PROCESESS WERE CHANGED TO REDUCE CHEMICALS

1983–1988 TOP 10 CHEMICALS PURCHASED BY THE PLANT IN 1984

	LB/YR (1984)	PRIMARY USER
1. SODIUM HYDROXIDE	1,623,000	METAL PREP
2. HYDROCHLORIC ACID	1,605,000	METAL PREP
3. TETRACHLOROETHYLENE	1,235,000	FAB
4. NITRIC ACID	1,100,000	METAL PREP
5. SULFURIC ACID	538,000	STEAM PLANT
6. FREON PCA (SOLVENT)	377,000	
7. 1,1,1-TRICHLOROETHANE	204,000	
8. METHYL ALCOHOL	150,000	UTILITIES
9. ALUMINUM TRIHYDRATE	140,000	METAL PREP
10. HYDROGEN FLUORIDE	65,000	METAL PREP

DEPLETED URANIUM 1,200,000 EST.

1983–1988 OTHER MATERIAL PURCHASES

1984	LBS/YR
COAL	240,000,000
GASOLINE	3,028,000
DIESEL FUELS	715,000
PAPER PRODUCTS	600 TYPES (EST.)

1983-1988 RECYCLE OF COOLANT DEPLETED URANIUM

- INSTALLED RECYCLE OF TRIMSOL FOR DEPLETED U MACHINE SHOPS
- BACTERIA CONTROL HAS BEEN A MINOR PROBLEM
- PAST 2 YEARS ONLY 1 WATER-ORGANIC COOLANT PURCHASED
- DRAGOUT LOSSES OF COOLANT OCCURS
- NO SIGNIFICANT REDUCTION IN PURCHASES

1983–1988 TETRACHLOROETHYLENE

- 735,000 LBS/YR REDUCTION IN PURCHASE OF PERCHLOROETHYLENE
- INCREASED PURCHASE OF TRICHLOROTRIFLUOROETHANE (FREON) - 60,000 LBS/YR
- PURCHASE OF PROPYLENE GLYCOL - 14,000 LBS/YR - DRAG OUT LOSSES

1983-1988 REDUCED METHYL ALCOHOL

- USED AS A REFRIGERANT
- PURCHASES DECREASED SUBSTANTIALLY BY PROCESS IMPROVEMENTS (UTILITIES DEPARTMENT)

1984	1988
150,783 LBS	69,431 LBS

- REDUCTION OF ABOUT 80,000 LBS/YR

1983–1988 HYDROGEN FLUORIDE

- NO SIGNIFICANT CHANGES

1983-1988 SODIUM HYDROXIDE REDUCTION

- LITHIUM CHEMISTRY HAD A REDUCTION, BUT IS EXPECTED TO INCREASE IN 1989

- ENRICHED URANIUM DECREASED ABOUT 67,000 LBS (CAUSTIC FUSION)

- STEAM PLANT REDUCED ABOUT 60,000 LBS AND WILL USE LESS BECAUSE OF NEW STEAM PLANT WATER TREATMENT FACILITY (SPWTF).

  - SPWTF NOW USES CALCIUM HYDROXIDE
  - IN PLACE OF SODIUM HYDROXIDE

- OVERALL PURCHASES DECREASED
  1,623,621 LBS IN 1984
  1,286,386 LBS IN 1988
  BUT EXPECTED TO INCREASE IN 1989

1983-1988 HYDROCHLORIC ACID

- METAL PREP IS A MAJOR USER
- MAIN PLATING SHOP ALSO A USER
- PURCHASES DECREASED, BUT WILL INCREASE IN 1989 (LITHIUM CHEMISTRY WAS DOWN ABOUT 1,000,000 LBS/YR)

1983–1988 SULFURIC ACID

- MAJOR USERS ARE STEAM PLANT AND WTO
- PURCHASES
  - 1984 538,606 LBS
  - 1988 464,049 LBS
- ABOUT 30,000 LBS IN DIRECT PURCHASES ALSO OCCURRED IN 1988 - TOTAL 1988 USE, ABOUT 494,000 LBS
- REDUCED AMOUNTS OF ABOUT 70,000 LBS/YR

1983-1988 RECYCLE OF MASSIVE DEPLETED URANIUM

- HIGH ENERGY PHYSICS LABORATORY (HEPL) USED MOST MASSIVE SCRAP
- HEPL USE EXPECTED TO END IN 1991
- SOME MASSIVE URANIUM RECYCLED FOR Y-12 USE

PURCHASE OF SOLVENTS AND REFRIGERANTS

	LB/YR 1984	LB/YR 1988
1. FREON PCA	377,00	231,000
2. TRICHLOROETHANE	204,000	158,000
3. TETRACHLOROETHYLENE *	524,000	63,000
4. TRICHLOROTRIFLURUROETHANE	0	60,337
5. FREON (6 TYPES)	17,400	18,300
6. METHYLENE CHLORIDE	22,400	4,200
7. CHLOROFORM	350	700
8. CARBON TETRACHLORIDE	27	53
SOLVENTS TOTAL	1,145,177	535,590
REFRIGERANTS (9 FREONS)	82,700	75,800

* NOTE: DOES NOT INCLUDE 735,000 LB/YR USED AS A COOLANT FOR MACHINING OF ENRICHED URANIUM

1983–1988 CHLORINATED/FREON SOLVENTS

- SEVERAL DEGREASING OPERATIONS CHANGED TO SOAP, WATER, AND ULTRASOUND RESULTED IN DECREASES:
  1 - 80,000 LB OF PERCHLOROETHYLENE
  2 - 177,000 LB OF FREON PCA
  (7500 LBS/YR FREON CHANGED TO WATER)
  3 - 20,000 LBS/YR OF TRICHLOROETHANE
  (FLOOR AND TOOL CLEANER)
  4 - ANISOLE SUBSTITUTED FOR METHYLENE CHLORIDE

- PURCHASE OF SOLVENTS **
  1984 1,145,177 LB/YR
  1988 535,590 LB/YR

- PURCHASE OF 9 TYPES OF REFRIGERANTS (ABOUT 80,000 LB/YR)

1983–1988 U AND U ALLOY CHIPS

- INSTALLED CHIP OXIDIZER - NOT CONSIDERED WASTE MINIMIZATION
- ELIMINATED BURIAL OF MOST OF U AND U ALLOY CHIPS
- U OXIDE IS STORED IN VAULTS
- MINIMIZED LAND

1983–1988 WATER PURIFIER FOR STEAM PLANT

- ☑ PILOT PLANT TEST COMPLETED ON ELECTRODIALYSIS (EDR)
- ☑ ECONOMIC STUDY COMPLETED ON EDR
- ☑ RESULTS SHOWED SIGNIFICANT REDUCTION POTENTIAL IN SULFURIC ACID, SODIUM CHLORIDE, AND COAL
- ☑ IN BUDGET CYCLE

1983–1988 NEAR-NET SHAPE FOR DEPLETED U

- NEAR-NET SHAPE ON A PART SHOWED REDUCTION IN BLANK VOLUME (W80)
- CHANGES MADE IN SOME PARTS FOR W88 AND B83

WASTE SEGREGATION

- MONITORING STATION INSTALLED FOR DEPLETED URANIUM MEASUREMENT IN DUMPSTERS
- TWO MONITORS OBTAINED FOR DEPLETED URANIUM MEASUREMENTS IN DRUMS
- SOME TRASH IS BEING SEGREGATED TO REMOVE URANIUM
- SOME CONTAMINATED TRASH IS BEING CHOPPED, BAILED, AND STORED ABOVE GROUND

1983-1988 MISCELLANEOUS IMPROVEMENTS

- MAGNESIUM CHIPS (21 CU FT/YR) - REUSED IN WTO
- KEVLAR GLOVES - RECYCLED , 30,000 PR/YR
- CLASSIFIED RUBBER GEL (42,000 CU FT/YR)- DECLASSIFIED BY SHREDDING
- REDUCED ACID FOR ICP SAMPLES
- REUSE OF RINSE WATER - MET LAB
- ELIMINATED FREON FOR PART CLEANING - PHYSICAL TEST LAB

1983–1988 PLATING SHOP

- ELIMINATED A CYANIDE PRE-PLATE STEP

1989 - 1994 FUTURE PROGRAMS

1988

1. SODIUM HYDROXIDE
2. NITRIC ACID
3. SULFURIC ACID
4. FREON PCA
5. HYDROCHLORIC ACID
6. 1,1,1-TRICHLOROETHANE
7. BELGUARD 550
8. ALUMINUM TRIHYDRATE
9. OIL (CODE BE)
10. METHYL ALCOHOL

1989 - 1994 NITRIC ACID AND ALUMINUM NITRATE

- INCREASED RECYCLE OF 30 % NITRIC ACID
- NEW EVAPORATOR WILL INCREASE ALUMINUM NITRATE
- BOTH CHANGES SHOULD DECREASE PURCHASE OF NITRIC ACID BY 30 TO 50% ABOUT 400,000 TO 600,000 LB/YR
- WILL DECREASE WASTE DISPOSAL OPERATIONS AT WETF
- WILL DECREASE SOLIDS GENERATED AT WETF

1989 –1994 PROCESS CHANGES AT WETF

- HEAD END MODIFICATIONS

  WILL REMOVE METALS BEFORE DENITRIFICATION

  WILL REDUCE GENERATION/STORAGE OF CO-CONTAMINATED SOLIDS BY EST. 75% OR MORE

1989 - 1994 DEPLETED URANIUM PROGRAM

- FUNDS REQUESTED

FY: 1990	$ 5.3 X MILLION
FY: 1991	$ 20.5 X MILLION
FY: 1992	$ 14 X MILLION
FY: 1993	$ 4.7 X MILLION
FY: 1994	$ 4.5 X MILLION

1989 - 1994 DEPLETED U PROGRAM (PAGE-2)

- PROGRAM

- STOCK MINIMIZATION
- BASIC MACHINING CONCEPTS
- CUT-OFF METHODS
- GRIT BLAST
- MASSIVE SCRAP RECYCLE
- CHIP RECYCLE
- E B MELT
- CHEMICAL PURIFICATION
- SUBSTITUTION

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