



**RELIABILITY &
ENERGY**

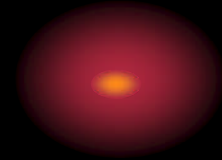
BUSINESS GOALS

- **SHE REGULATORY COMPLIANCE**
- **INCREASED RELIABILITY**
 - **AVAILABILITY**
 - **LOST PRODUCTION**
- **REDUCED COSTS**
 - **EMPHASIS ON FIXED EXPENDITURES**
 - **MANAGE vs. ELIMINATE RISK**
 - **MAINTENANCE**
 - **ENERGY**



BUSINESS CLIMATE

- **PRODUCTION AT REDUCED RATES**
- **HEAVY EMPHASIS ON 'FIXED COSTS' REDUCTIONS**
- **DEFERRED MAINTENANCE**
- **INCOMPLETE REPAIRS**
- **TRADITIONAL EMPHASIS ON ROTATING EQUIPMENT**

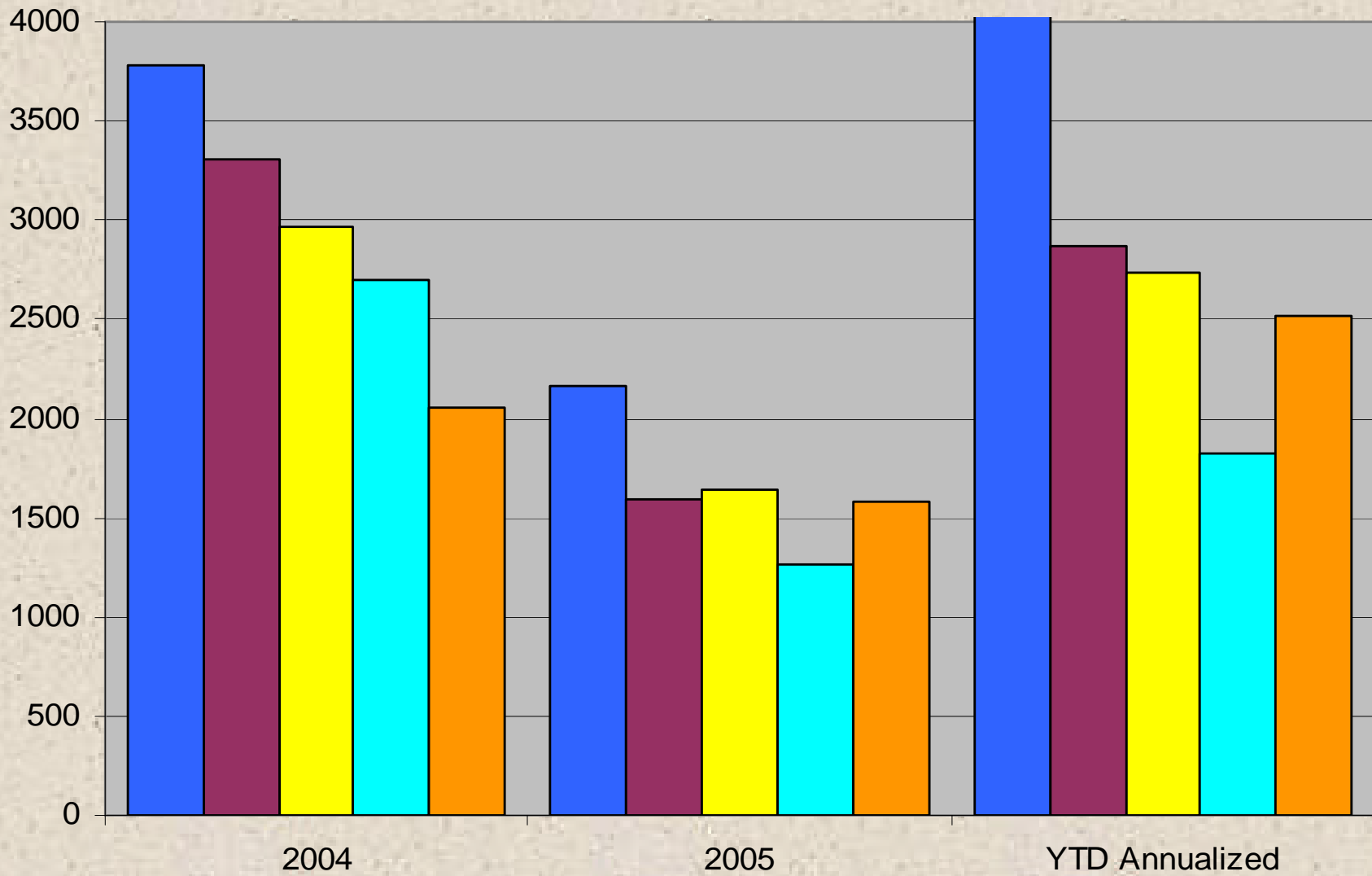


PLAN

- **DEVELOP PARETO CHART FOR MAINTENANCE COSTS**
- **DETERMINE FACTORS FOR COSTS OF EQUIPMENT CLASSES**
 - **DESIGN**
 - **ENVIRONMENT**
 - **MAINTENANCE STRATEGY**
- **DEVELOP JUSTIFICATION FOR CHANGES**



Total Costs, 1st Tier



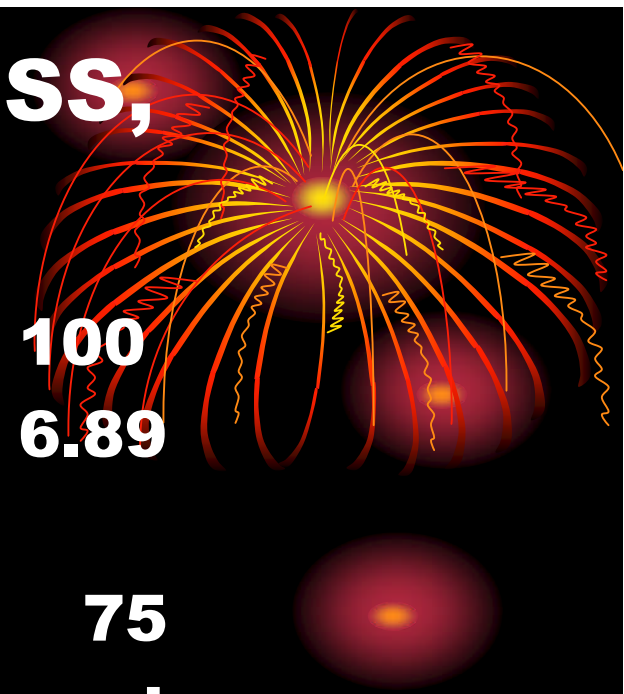
■ Process Pipe ■ Exchangers ■ Reactors ■ Instruments ■ Utility Pipe

ACTION ITEMS

- **REPAIR-TO-STANDARDS**
- **REVISED SOME STANDARDS**
 - **SMALL BORE PIPE WALL THICKNESS**
 - **PAINTS AND COATINGS**
 - **INSULATION MATERIAL**
- **EMPLOYED ENERGY TOOLS TO HELP JUSTIFY IMPROVEMENTS**
- **TRAINING**



UNINSULATED HEAT LOSS, \$/YEAR



Lenth of Uninsulated Pipe, ft.
NG Price, \$/MMBtu

100
6.89

Pipe Size	650	200	75
<u>Inches</u>	<u>psig</u>	<u>psig</u>	<u>psig</u>
1/2	4,795	3,335	2,432
1	6,421	4,423	3,197
4	15,654	10,431	7,379
8	26,340	17,246	12,037

STEAM LEAK COST, \$/DAY

NG Price, \$/MMBtu – 6.89



Hole Size, Inches

1/32 1/16 1/8 3/16 1/4 3/8

75# Steam	0	1	1	12	22	49
200# Steam	1	4	17	38	67	150
650# Steam	3	14	54	122	217	488

RISK MATRIX

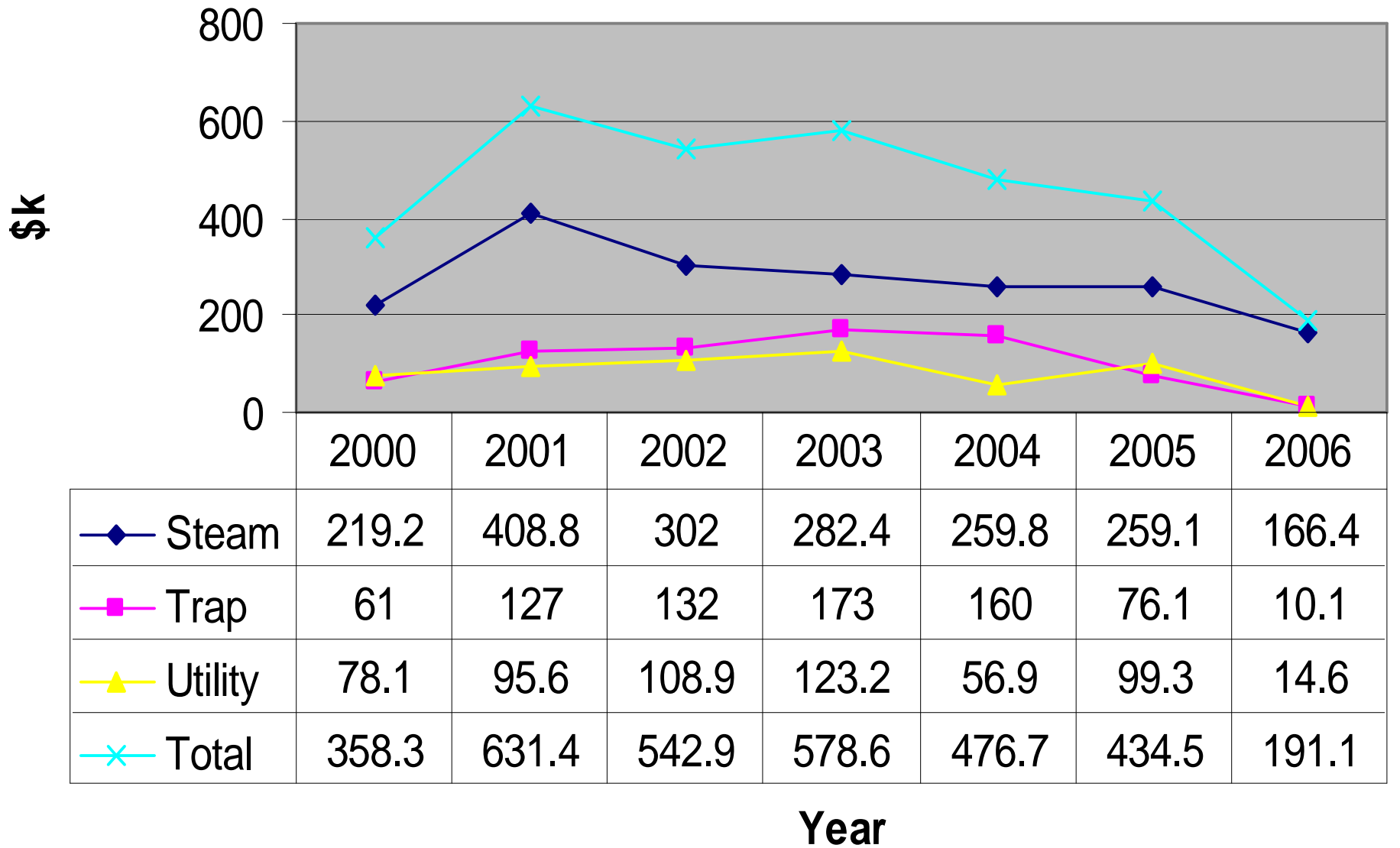
PROBABILITY ↑	A	1	2	2	1	1
	B	4	1	2	2	1
	B	4	4	1	2	1
	D	4	4	1	1	2
	E	4	4	4	1	1
		V	IV	III	II	I
	CONSEQUENCE →					

RESULTS

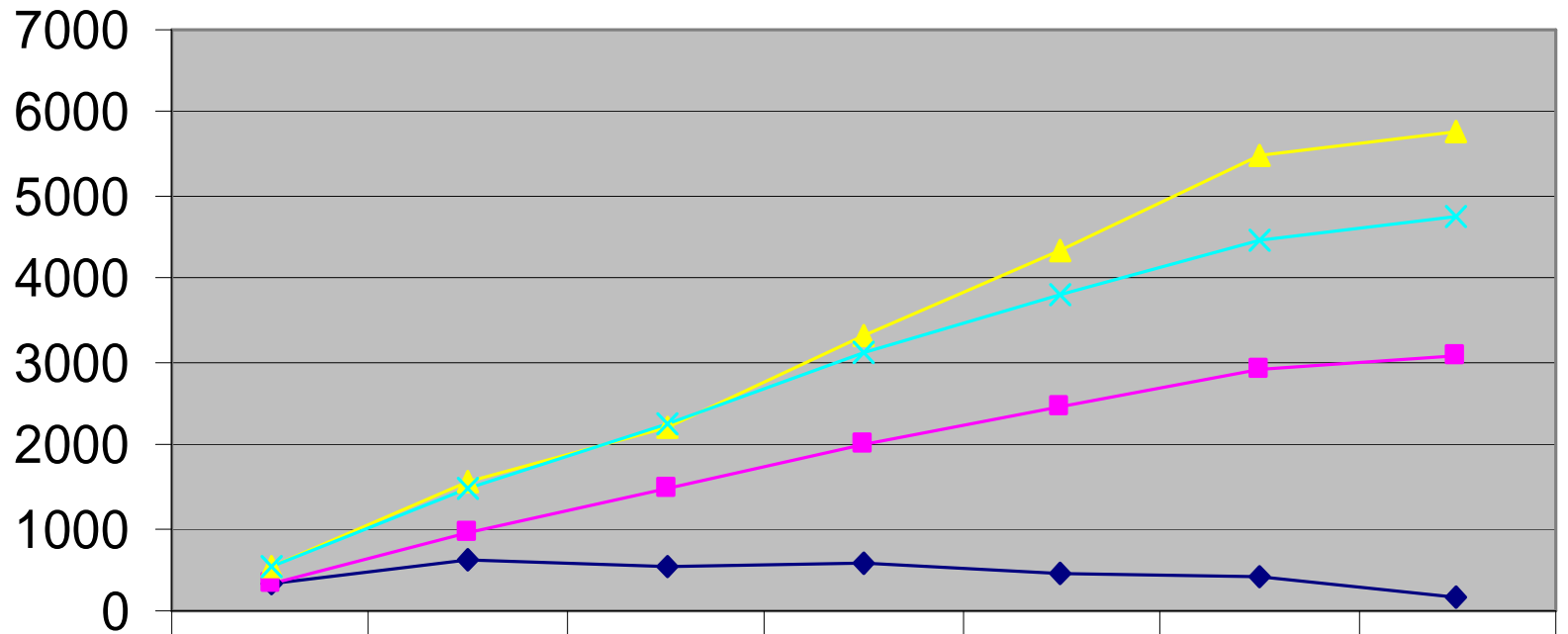
- **INSULATED 12,000 FEET OF SMALL BORE STEAM PIPING**
 - **HEAT LOSS SAVINGS 2-3 TIMES INVESTMENT**
 - **INCREASED PIPE LIFE**
- **REDUCED TIME TO REPAIR STEAM LEAKS**
 - **\$800k ANNUAL SAVINGS POTENTIAL**
 - **REDUCED DAMAGE TO ADJACENT PIPE**
- **RE-INSTITUTED STEAM TRAP SURVEYS AND REPAIR**



Steam Leak Repair Costs



Steam Leaks & Losses



	2000	2001	2002	2003	2004	2005	2006
◆ N. Ann. Lks.	342	603	518	553	455	415	183
■ N. Cum. Lks	342	945	1463	2016	2471	2886	3069
▲ \$kCum.Loss	529	1560	2204	3324	4327	5485	5788
× Const. Price	529	1463	2265	3121	3825	4468	4751

Year

TPM PILLARS

- **EQUIPMENT WELLNESS**
- **FOCUSED IMPROVEMENT**
- **PLANNED MAINTENANCE**
- **EARLY EQUIPMENT MANAGEMENT**
- **TRAINING**
- **QUALITY MAINTENANCE**
- **ADMINISTRATIVE SUPPORT**
- **SAFETY, HEALTH, ENVIRONMENTAL**

