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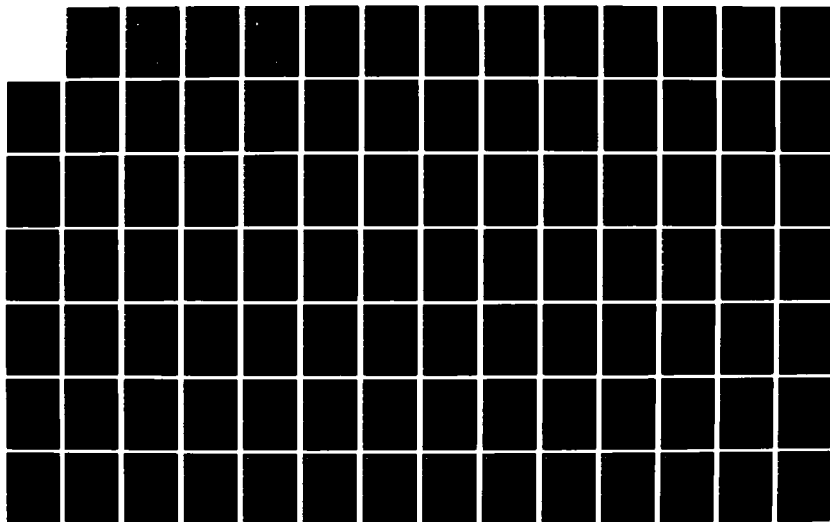
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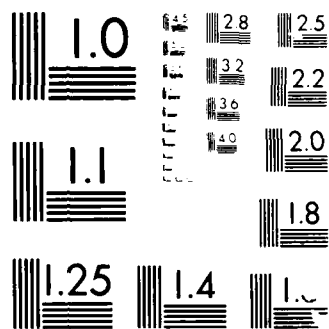
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Waste Minimization Program

Air Force Plant 42

AD-A191 837

Prepared for:

U.S. Air Force System Command
Aeronautical Systems Division/PMD
Wright-Patterson, AFB, OH 45433
Contract - F09603-84-G-1462-SC01

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Waste Minimization Program

Air Force Plant 42

Prepared for:

**U.S. Air Force System Command
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 **The Earth Technology
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Alexandria, VA 22314**

February 1986

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This report was prepared by the Earth Technology Corporation under Contract Number F09603-84-G-1462-SC01 for the AFSC, Aeronautical Systems Division (ASD/PMD). Mr. Charles H. Alford was the Project Officer for ASD/PMD. Mr. Richard R. Pannell was Program Manager and Mr. Brian J. Burgher, P.E., Mr. Douglas Hazelwood and Mr. Eric Hillenbrand were principal investigators for The Earth Technology Corporation.

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1.0 INTRODUCTION

This report presents the findings of an assessment of waste minimization opportunities at Air Force Plant 42 in Palmdale, California. It is part of the Waste Minimization Program being conducted by the Air Force Systems Command, Aeronautical Systems Division/Facilities Management Division (ASD/PMD) for eight (8) Government-Owned, Contractor-Operated (GOCO) facilities to promote prudent waste management by exploiting opportunities to reduce costs and conserve resources.

A project team completed a site investigation of AFP 42 operations during the week of August 19-23, 1985 to review facility operations and discuss opportunities for waste reduction with plant engineering staffs. Based upon this investigation and subsequent analyses, this report presents the status of current waste generation and minimization programs and recommends other potential methods for reducing current waste volumes. Tables of waste volumes before and after minimization have been prepared to provide an indication of planned and projected waste reduction possible through planned system modifications. Finally, recommendations for implementation of opportunities which could further reduce waste generation and disposal are provided.

1.1 BACKGROUND

Interest in waste minimization has long been promoted by Federal legislation, including the Federal Water Pollution Control Act Amendments of 1972, the Energy Policy and Conservation Act of 1975 and the Used Oil Recycling Act as well as DOD directives such as AFR 78-22 and DODD 19-14. More recently, the impetus for waste minimization has become even stronger. The reauthorization of RCRA includes bans on landfilling of certain waste types and a requirement for certification that waste minimization is being conducted by hazardous waste generators. Similarly, DOD has issued directives requiring zero land disposal of solvents by 1986.

ASD/PMD anticipated these developments and initiated programs in 1983 to address these issues. A preliminary identification of resource conservation and recovery activities and opportunities was included in an environmental audit program conducted in 1983 for fifteen (15) facilities. ASD/PMD contracted a further study of resource conservation and recovery opportunities at eleven (11) GOCO facilities in 1984. This effort resulted in a preliminary assessment of opportunities for industrial and non-industrial (i.e., solid or municipal) waste streams.

The methodology for this effort relied primarily on data acquired during the environmental audit program conducted in 1983 supplemented with conversations and information exchanges between the study team and GOCO contractor personnel. The results of this investigation were an indication of the areas where resource conservation and recovery opportunities appeared to be most substantial, and the areas where opportunities were not promising. Through application of a consistent methodology, facilities with substantial opportunities and measures warranting further investigation were identified.

The 1984 study demonstrated that plant operators were implementing methods that could substantially reduce waste generation volumes and raw material requirements to reduce their waste management costs and potential liabilities associated with waste land disposal. However, opportunities for waste minimization were identified which appeared both technically and economically feasible but were not being implemented.

In light of the findings of these studies and the new certification requirements of RCRA, ASD/PMD is adopting a Waste Minimization Program. This program is promoting prudent waste management by exploiting opportunities to reduce costs and conserve resources. It is intended to establish for ASD/PMD the status of progress in this area, and to demonstrate facility advances in alternate waste management methods. In addition, it is expected that new opportunities determined to be infeasible in the past will be identified for possible implementation.

1.2 OBJECTIVES

The ASD/PMD Waste Minimization Program is designed to promote waste management opportunities which reduce the reliance on land disposal by GOCO facilities and which result in increased efficiency in the utilization of resources. As part of this program, this study has the following objectives:

1. Define the status of waste generation and existing minimization concepts at AFP 42.
2. Support feasible alternatives identified by the AFP 42 contractors.
3. Identify and evaluate new opportunities not being implemented at AFP 42.
4. Stimulate technology transfer between AFP 42 and other Air Force GOCO facilities as well as with other DOD installations.

5. Continue to increase the awareness of the importance of waste minimization.
6. Provide information needed to confidently certify that waste minimization is being employed at AFP 42 to satisfy RCRA requirements and DOD directives.

2.0 CONCLUSIONS AND RECOMMENDATIONS

Air Force Plant 42, located in Palmdale, California, is operated by four contractors - Rockwell International, Northrop Corporation, Lockheed-California, and Nero and Associates. AFP 42 occupies 5,832 acres of land, of which 1010 acres are used for industrial production operations in 5 separate sites. Adjoining AFP 42 are the Lockheed Palmdale Complex and Rockwell International's North American Aircraft Operations.

A summary of the conclusions, recommendations and economics resulting from an investigation of waste minimization opportunities at AFP 42 is presented below for each AFP 42 contractor.

2.1 ROCKWELL INTERNATIONAL

Rockwell International operations at AFP 42 consist of final assembly, painting, and testing of the B-1B Bomber. These operations are carried out on Site 3 (which is entirely occupied by Rockwell except for half of Building 315, which is subleased to Northrop) and Site 1 (which is entirely occupied by Rockwell and was formerly used for the Space Shuttle Program). Site 8 is used by Rockwell for warehousing and production support and is shared with both Lockheed and Northrop. Rockwell operations cover approximately 650,000 feet of floor space and employ 3000 people. Rockwell is currently operating at a rate of about one aircraft per month and is accelerating to achieve a full production rate of four aircraft per month in 1986.

Rockwell generates significant volumes of waste at AFP 42 through cleaning, surface preparation, painting, and testing activities. Approximately 632,000 lb of waste were generated at Rockwell in 1984; some of this waste was probably generated at Rockwell's Palmdale plant, but because wastes from AFP 42 and Rockwell-Palmdale are manifested together, it is difficult to separate waste quantities for waste which are generated at both plants. The rate of waste generation is expected to increase significantly when full production is reached. Rockwell currently reduces the amount of waste sent off-site for disposal by treating 350,000 lb of paint booth wastes and 15 million lb of waste deionizing regenerant solution on-site followed by discharge to the Plant 42 wastewater treatment plant. The rate of waste generation at Rockwell can be further reduced through additional minimization measures.

2.1.1 Conclusions

A summary of 1984 waste generation and disposal volumes, currently planned reductions, and additional potential reductions being considered by Rockwell is provided in Table 2-1. A brief description of planned and potential waste reduction methods is provided in Table 2-2. An analysis of these data result in the following conclusions.

TABLE 2-1.
AFP 42: ROCKWELL
PROJECTED WASTE DISPOSAL

WASTE STREAM		1984 GENERATION (POUNDS)	1984 LAND DISPOSAL (POUNDS)	PROJECTED LAND DISPOSAL W/PLANNED MINIMIZATION (POUNDS)	PROJECTED LAND DISPOSAL W/PROPOSED MINIMIZATION (POUNDS)
1.	Flammable Liquid Waste	76,000	-	-	-
2.	Flammable Solid Waste	97,000	97,000	164,000	-
3.	Empty Drums	120,000	120,000	600,000	-
4.	Paint Booth Waste	350,000	-	-	-
5.	Ion Exchange Resin Waste	10,000	10,000	10,000	-
6.	Diesel Fuel Waste	25,000 ²	-	-	-
7.	Regenerant Waste	14,400,000	-	-	-
8.	Ammonia Waste	4,000	4,000	20,000	-
9.	Rag Waste	325,000	325,000	650,000	130,000
TOTALS		15,741,000	556,000	1,440,000	130,000
REDUCTIONS		--	--	(+159%)	91%

Projected disposal estimates include expected increases in waste generation as Rockwell reaches full B-1B production in 1986. Therefore, projected disposal typically greatly exceeds the 1984 generation rate, when B-1B operations were starting up.

² These wastes are not generated at Rockwell on an on-going basis.

TABLE 2-2.
AFP 42: ROCKWELL
SUMMARY OF
CURRENT, PLANNED AND PROPOSED
WASTE MANAGEMENT METHODS

WASTE STREAM	PRESENT METHOD	PLANNED CHANGES	PROPOSED CHANGES
1. Flammable Liquid Waste	Off-site reuse as fuel	None	a) On-site recycle b) On-site reuse as fuel c) Off-site recycle
2. Flammable Solid Waste	Landfill	None	a) On-site recycle b) Off-site recycle c) Off-site reuse as fuel
3. Empty Drums	Landfill	None	Off-site reconditioning
4. Paint Booth Waste	On-site treatment	None	None
5. Ion Exchange Resin Waste	Landfill	None	Off-site regeneration
6. Diesel Fuel Waste	Off-site treatment	None	None
7. Regenerant Solution Waste	On-site treatment	None	None
8. Ammonia Waste	Landfill	None	Off-site treatment
9. Rag Waste	Landfill	None	On-site recycle by cleaning

1. Current minimization measures have reduced wastes generated for off-site disposal by a total of 15.4 million lb. These measures are on-site treatment by ion exchange of paint booth wastes, and on-site treatment by neutralization of waste regenerant solutions.

In addition, waste flammable liquids are currently recycled off-site through reuse as fuel, reducing the volume of wastes for land disposal.

Wastes generated on an on-going basis at Rockwell which are disposed of through land disposal include:

- o Flammable solid waste
- o Empty drums
- o Ion exchange resin waste
- o Solidified ammonia waste
- o Rag waste.

2. Additional opportunities for waste minimization at Rockwell include:

- o On-site recycling of waste flammable hydraulic oils through filtration and, if necessary, flash vaporization. This would reduce off-site waste flammable liquid disposal by 73 percent.
- o On-site recycling of waste flammable solvents by distillation which could reduce the volume of waste flammable liquids for off-site disposal by an additional 17 percent. If waste flammable liquids (hydraulic oil and solvent) can not be recycled on-site, they may be able to be recycled as fuel on-site. However, new regulations governing on-site burning of waste fuels in California are expected in 1986; these regulations may make on-site burning impractical. If waste flammable liquids can not be recycled on-site or reused as fuel, they may be able to be reused off-site to recapture more of their value than is currently recaptured through off-site reuse as fuel.
- o On-site or off-site recycling or reuse as fuel of waste flammable solids can reduce the volume of this waste sent to land disposal by 100 percent.

- o Off-site reconditioning of waste empty drums can reduce the volume of this waste sent to land disposal by 100 percent.
- o Off-site reclamation of ion exchange resin waste by acid regeneration can reduce the volume of this waste sent to land disposal by 100 percent.
- o Off-site treatment of ammonia waste can reduce the volume of this waste sent to land disposal by 100 percent.
- o On-site recycling of rags through dry cleaning can reduce the volume of this waste sent to land disposal by approximately 80 percent.

2.1.2 Recommendations

Based on the findings of this waste minimization investigation of Rockwell operations at AFP 42, the following is an inventory of recommendations made with the objective of minimizing current waste disposal.

1. Flammable Liquid Waste

1. Implement on-site recycling of waste hydraulic oils with existing filtration unit and additional units as needed.
2. Evaluate on-site recycling of waste solvents through distillation.
3. Evaluate on-site reuse as fuel after revised state regulations are issued if on-site recycling is not feasible.
4. Investigate off-site recycling of waste hydraulic oils and/or waste solvent if either or both can not be recycled on-site.

2. Flammable Solid Waste

1. Stop current practice of solidifying these wastes with vermiculite.

2. Evaluate on-site recycling through distillation.
 3. Investigate off-site recycling if on-site recycling is not feasible.
 4. Investigate off-site reuse as fuel if on-site and off-site recycling are not feasible.
3. Empty Drums
 1. Investigate off-site drum reconditioning at an acceptable drum reconditioner identified by DOHS.
 4. Ion Exchange Resin Waste
 1. Investigate off-site regeneration by a water treatment or water softening service.
 5. Ammonia Waste
 1. Investigate off-site treatment at an industrial wastewater treatment facility.
 6. Rag Waste
 1. Consider establishment of an on-site cleaning facility to recycle rags in conjunction with the other AFP 42 contractors and the Air Force.

2.1.3 Economics

Table 2-3 summarizes the economics of some of the waste minimization measures developed through this investigation. Economics are order of magnitude estimates only and should not be used in place of detailed engineering estimates which consider contractor labor, engineering and administration costs and facility specific costs. Where costs were not available from Rockwell, estimates are based on standard cost references, vendor quotes or experience with similar capital projects.

TABLE 2-3
APP 42: ROCKWELL
POTENTIAL WASTE MINIMIZATION ECONOMICS

WASTE	OPTION	CAPITAL COST (\$)	ANNUAL O&M COST (\$/YR)	INCREASED ANNUAL SAVINGS (\$/YR)	PAYBACK (YR)
1. Flammable Liquid Waste	a) On-site hydraulic oil recycling	20,000-	12,000	250,000 ²	-
	b) On-site solvent recycling	44,000	300	10,500 ³	0.7
	c) On-site reuse as fuel	2,500	Negl.	3,000	0.8
	d) Off-site recycling	0	0	N/A ⁴	-
2. Flammable Solid Waste	a) On-site solvent recycling	13,500	2,000	14,100 ⁵	1.1
	b) Off-site recycling	0	0	N/A	-
	c) Off-site reuse as fuel	0	0	N/A	-
3. Empty Drums	Off-site recon- ditioning	0	0	4,500 ⁶ 9,000	-
4. Ion Exchange Resin Waste	Off-site regeneration	0	0	N/A	-
5. Ammonia Waste	Off-site treatment	0	0	1,160	-

- 1 Increased savings calculated based on projected waste generation rates.
- 2 Savings based on purchase cost only; savings on current disposal cost not included.
- 3 Assumes only 10 percent of solvent can be recycled for use on-site.
- 4 Data not available
- 5 Assumes on Blend 1 waste solvent can be reused
- 6 Savings based on resale value only; savings on current disposal cost not included.

2.2 NORTHROP

Northrop activities at AFP 42 involve final assembly and painting of the F-5 fighter aircraft. Production of the F-5 plane is currently declining, and activity at Northrop is at a very low production level. Currently, 175 people are working at Northrop on the F-5 program on a one shift, five day schedule. Northrop operations occupy the majority of Site 7 at AFP 42; the remainder of Site 7 is occupied by Lockheed. Northrop also uses part of Building 315 on Site 3, which is primarily occupied by Rockwell, for painting.

Northrop generates 45,760 lb of waste at AFP 42. Northrop effectively minimizes the amount of wastes sent to land disposal by disposing of 34,600 lb, or 76 percent, of this waste through off-site reuse as fuel.

2.2.1 Conclusions

A summary of 1984 waste disposal volumes, currently planned reductions, and additional potential reductions being considered by Northrop is provided in Table 2-4. A brief description of planned and potential waste reduction methods is provided in Table 2-5. An analysis of these data result in the following conclusions.

1. Northrop currently minimizes wastes disposed by land disposal by sending all flammable wastes off-site for reuse as fuel. Wastes sent off-site for land disposal are limited to paint booth waste and rag waste, which are only 12 percent of the total waste generated at Northrop.
2. Northrop plans to recycle chlorinated solvents through distillation at Northrop - Hawthorne. This will reduce off-site disposal by recycling this waste on Northrop property rather than sending it to a third party for reuse as fuel.
3. Additional opportunities for minimizing off-site disposal include:
 - o On-site recycling of Turco 4460 and other non-chlorinated thinning compounds may be possible using a small distillation unit, if recovered product is of satisfactory quality to be reused. On-site recycling would reduce the volume of waste thinning compounds sent off-site for disposal by 50 percent.

TABLE 2-4
AFP 42: NORTHROP
PROJECTED WASTE DISPOSAL

Waste Stream		1984 Generation (Pounds)	1984 Land Disposal (Pounds)	Projected Land Disposal W/Planned Minimization ¹ (Pounds)	Projected Land Disposal W/Proposed Minimization ² (Pounds)
1.	Thinning Compound Waste	10,720	-	-	-
2.	Flammable Solvents Waste	3,080	-	-	-
3.	Jet Fuel Waste	11,560	-	-	-
4.	Paint Waste	9,450	-	-	-
5.	Paint Booth Waste	3,750	3,750	3,750	-
6.	Hydraulic Oil Waste	5,500	-	-	-
7.	Fuel Oil Waste	9,170	-	-	-
8.	Rag Waste	1,700	1,700	2,500	500
TOTALS		46,670	5,450	6,250	500
% REDUCTIONS		--	--	(+15%)	91%

- 1 Projected disposal estimates include planned increases in waste generation due to increased production activities in particular areas.
- 2 This waste is not generated at Northrop on an on-going basis.

TABLE 2-5.
AFP 42: NORTHROP
SUMMARY OF
CURRENT, PLANNED AND PROPOSED
WASTE MANAGEMENT METHODS

WASTE STREAM	PRESENT METHOD	PLANNED CHANGES	PROPOSED CHANGES
1. Thinning Compound Waste	Off-site reuse as fuel	None	a) On-site recycle b) On-site reuse as fuel c) Off-site recycle
2. Flammable Solvent Waste	Off-site reuse as fuel	None	On-site reuse as fuel
3. Jet Fuel Waste	Off-site reuse as fuel	None	On-site reuse as fuel
4. Paint Waste	Off-site reuse as fuel	None	None
5. Paint Booth Waste	Landfill	None	None
6. Hydraulic Oil Waste	Off-site reuse as fuel	None	a) On-site recycle b) On-site reuse as fuel
7. Fuel Oil Waste	Off-site reuse as fuel; landfill	None	None
8. Rag Waste	Landfill	None	On-site recycle by cleaning

If waste non-chlorinated thinners can not be recycled on-site through distillation, they may be able to be reused on-site as fuel. However, new regulations governing on-site burning of waste fuels in California are expected in 1986; these regulations may make on-site burning impractical. If waste non-chlorinated thinning compounds can not be recycled or reused as fuel on-site, they may be able to be recycled off-site to recapture more of their value than is currently recaptured through off-site reuse as fuel.

- o Waste flammable solvents (Stoddard, IPA, cellosolve acetate, etc.) may be reused on-site as fuel subject to the possible restrictions noted above.
- o Waste jet fuel may be sent off-site for refining to recapture more of its value than is currently recaptured through off-site reuse as fuel. If waste jet fuel cannot be re-refined, it may be able to be reused on-site as fuel subject to the possible restrictions noted above.
- o On-site recycling of waste hydraulic oils should be possible using filtration and flash vaporization or vacuum distillation units. This would reduce the volume of hydraulic oil waste sent off-site for disposal by 90 percent. If hydraulic oils can not be recycled, they may be able to be reused on-site as fuel subject to the possible restrictions noted above.
- o On-site recycling of rags through dry cleaning can reduce the volume of this waste sent to land disposal by 80 percent.

2.2.1 Recommendations

Based on the findings of this waste minimization investigation of Northrop operations at AFP 42, the following are our inventory of recommendations made with the objective of further reducing current waste disposal volumes.

1. Thinning Compound Waste

1. Evaluate on-site recovery of Turco 4460 by distillation.
2. Evaluate on-site reuse of waste as fuel if recycling is not feasible.
3. Investigate off-site recycling if neither on-site recycling nor reuse as fuel is feasible.
4. Proceed with plans to recycle chlorinated thinning compounds (Turco Lock) at Northrop-Hawthorne.

2. Flammable Solvent Waste

1. Evaluate on-site reuse as fuel.

3. Jet Fuel Waste

1. Investigate off-site recycling at a refinery or re-refinery.
2. Evaluate on-site reuse as fuel if no off-site recycler is identified.

4. Hydraulic Oil Waste

1. Evaluate on-site recycling using filtration and, if necessary, vacuum distillation or flash vaporization.
2. Evaluate on-site reuse as fuel if recycling is not feasible.

5. Rag Waste

1. Consider establishment of an on-site cleaning facility to recycle rags in conjunction with the other AFP 42 contractors and the Air Force.

2.2.3 Economics

Table 2-6 summarizes the economics of some of the waste minimization measures developed through this investigation. Economics are order of magnitude estimates only and should not be used in place of detailed engineering estimates which consider contractor labor, engineering and administration costs and facility specific costs. Where costs were not available from Northrop, estimates are based on standard cost references, vendor quotes or experience with similar capital projects.

TABLE 2-6
 AFP 42: NORTHROP
 POTENTIAL WASTE MINIMIZATION ECONOMICS

WASTE	OPTION	CAPITAL COST (\$)	ANNUAL O&M COST (\$/YR)	INCREASED ANNUAL SAVINGS (\$/YR)	PAYBACK (YR)
1. Thinning Compound Waste	a) On-site solvent recycling	7,000	200	6,700	1.1
	b) On-site reuse as fuel	1,500	0	500	3.0
	c) Off-site recycling	0	0	N/A	-
2. Flammable Liquid Waste	On-site reuse as fuel	1,500	0	225	6.7
3. Jet Fuel Waste	a) Off-site recycling	0	0	N/A	-
	b) On-site reuse as fuel	1,500	0	870	1.7
4. Hydraulic Oil Waste	a) On-site recycling	11,000	160	3,550	3.0
	b) On-site reuse as fuel	1,500	0	420	3.6

2.3 LOCKHEED

Lockheed operations at AFP 42 are related to advanced aircraft development projects. Operations generally are related to assembly and maintenance of U-2R, SR-71, and TR-1 aircraft. These operations include engine, hydraulic and mechanical system inspection and maintenance; paint stripping and repainting; and fueling/defueling. Lockheed operations occur primarily on Site 2 and Site 7, which Lockheed shares with Northrop. Lockheed operations are carried out on a one shift, five day schedule.

Lockheed generates a relatively small amount of waste at AFP 42, most of which (73 percent) is wastewater from paint stripping operations. Lockheed currently minimizes off-site land disposal of wastes by sending recoverable wastes, such as waste fuel and water and waste hydraulic oils, to recyclers; additionally, they recycle dirty hydraulic oils on-site as long as they are not contaminated with chlorinated compounds.

2.3.1 Conclusions

A summary of 1984 waste disposal volumes, currently planned reductions, and additional potential reductions being considered by Lockheed is provided in Table 2-7. A brief description of planned and potential waste reduction methods is provided in Table 2-8. An analysis of these data result in the following conclusions.

1. Lockheed currently recycles hydraulic oil waste on-site through filtration if they do not contain chlorine. Additionally, they recycle chlorine contaminated hydraulic oil and fuel waste off-site, and solvent waste are sent off-site for reuse as fuel. Only two waste streams -- paint stripping waste and rag waste -- are disposed of through land disposal.
2. Additional opportunities for minimizing waste or improving current reuse practices include:
 - o Reducing the generation of paint stripper waste by segregating clean roof runoff and safety water from paint stripping water. These materials are currently collected together in one tank. These measures will reduce generation of paint stripping waste by 42 percent.

TABLE 2-7
AFP 42: LOCKHEED
PROJECTED WASTE DISPOSAL

Waste Stream	1984 Generation (Pounds)	1984 Land Disposal (Pounds)	Projected Land Disposal W/Planned Minimization ¹ (Pounds)	Projected Land Disposal W/Proposed Minimization (Pounds)
1. Paint Stripper Waste	1,180,200	1,180,200	3,502,800 ¹	-
2. Fuel Waste	379,400	-	-	-
3. Hydraulic Oil Waste	15,200	-	-	-
4. Solvent Waste	8,000	-	-	-
5. Rag Waste	40,800	40,800	40,800	8,200
TOTALS	1,624,000	1,221,000	3,555,000	8,200
% REDUCTIONS	--	--	(+190%)	99%

Projected disposal estimates include planned increases in waste generation due to increased production activities.

TABLE 2-8
AFP 42: LOCKHEED
SUMMARY OF
CURRENT, PLANNED AND PROPOSED
WASTE MANAGEMENT METHODS

WASTE STREAM	PRESENT METHOD	PLANNED CHANGES	PROPOSED CHANGES
1. Paint Stripper Waste	Landfill	None	Reduce rinsewater volumes; Off-site treatment
2. Fuel Waste	Off-site recycle	None	None
3. Hydraulic Oil Waste	Off-site recycle	None	a) On-site recycle b) On-site reuse as fuel
4. Solvent Waste	Off-site reuse as fuel	None	None
5. Rag Waste	Landfill	None	On-site recycle by cleaning

- o On-site recycling of chlorine contaminated hydraulic oils may be accomplished using a filtration and flash vaporization or vaduum distillation system. This would reduce the volume of waste hydraulic oils sent off-site by 90 percent. If on-site recycling of chlorine contaminated hydraulic oils is not feasible, these oils may be able to be reused on-site for fuel. However, regulations expected to be issued in 1986 may make on-site reuse impractical.
- o On-site recycling of rag waste through cleaning, in conjunction with other AFP 42 contractors.

2.3.2 Recommendations

Based on the findings of this waste minimization investigation of Lockheed operations at AFP 42, the following is an inventory of recommendations made with the objectives of minimizing current waste disposal.

1. Paint Stripper Waste

- 1. Reroute roof runoff to the pavement around Building 211 or to storm drainage ditches.
- 2. Equip safety water hoses with trigger type nozzles or collect safety water separately and discharge it to the pavement around Building 211.
- 3. Investigate off-site treatment of rinsewaters at an industrial waste treatment facility.

2. Hydraulic Oil Waste

- 1. Evaluate on-site recycling of chlorine contaminated hydraulic oils using filtration/flash vaporization or filtration/vacuum distillation units.
- 2. If hydraulic oils can not be satisfactorily recycled, evaluate on-site reuse as fuel.

3. Rag Waste

- 1. Consider on-site recycling of rags in a dry cleaning facility in conjunction with the other AFP 42 contractors and the Air Force.

2.3.3 Economics

Table 2-9 summarizes the economics of some of the waste minimization measures developed through this investigation. Economics are order of magnitude estimates only and should not be used in place of detailed engineering estimates which consider contractor labor, engineering and administration costs and facility specific costs. Where costs were not available from Lockheed, estimates are based on standard cost references, vendor quotes or experience with similar capital.

TABLE 2-9
APP 42: LOCKHEED
POTENTIAL WASTE MINIMIZATION ECONOMICS

WASTE	OPTION	CAPITAL COST (\$)	ANNUAL O&M COST (\$/YR)	INCREASED ANNUAL SAVINGS (\$/YR)	PAYBACK (YR)
1. Paint Stripper Waste	a) Reroute roof drains	2,000	0	35,000	Immediate
	b) Segregate safety water	50	0	12,000	Immediate
	c) Off-site treatment	0	0	N/A	-
2. Hydraulic Oil Waste	a) On-site recycling	11,000	360	7,300 ¹	1.6
	b) On-site reuse as	1,500	0	N/A ²	-

- 1 Savings based on avoided on material purchase only; disposal cost data were not available.
- 2 Savings would be based solely on disposal costs, which were not available.

2.4 NERO AND ASSOCIATES

Nero and Associates provides plant maintenance and emergency response services at AFP 42. These services include vehicle maintenance, runway maintenance, building painting, and operating the AFP 42 wastewater treatment plant. Nero employs 212 people at AFP 42.

Waste generation at Nero and Associates is relatively low; in 1984, waste generation was 29,000 lb. Nero currently minimizes the amount of waste sent to land disposal by sending all flammable wastes to a fuel blending facility, and by sending empty drums to a drum reconditioner; only 25 percent of Nero's waste is landfilled.

2.4.1 Conclusions

A summary of 1984 waste disposal volumes, currently planned reductions, and additional potential reductions being considered by Nero is provided in Table 2-10. A brief description of planned and potential waste reduction methods is provided in Table 2-11. An analysis of these data result in the following conclusions.

1. Nero currently minimizes the amount of wastes sent to land disposal by sending wastes to off-site reconditioners or fuel blenders. All flammable wastes and empty drums are reused. The only Nero waste disposed of by land disposal is rag waste.
2. Wastes sent for off-site management can be minimized through the following means identified during this study:
 - o On-site reuse as fuel of oil waste, jet fuel waste, and solvent waste. These materials can be burned on-site in Nero's steam boilers. However, new regulations governing on-site reuse of wastes as fuel are expected in 1986; these regulations may make on-site reuse as fuel impractical.
 - o On-site recycling of rag waste in a central dry cleaning plant serving all AFP 42 contractors. This would reduce the amount of waste sent to landfill by Nero by 80 percent.

TABLE 2-10
AFP 42: NERO AND ASSOCIATES
PROJECTED WASTE DISPOSAL

Waste Stream	1984 Generation (Pounds)	1984 Land Disposal (Pounds)	Projected Land Disposal W/Planned Minimization ¹ (Pounds)	Projected Land Disposal W/Proposed Minimization ¹ (Pounds)
1. Oil Waste	12,500	-	-	-
2. Jet Fuel Waste	4,500	-	-	-
3. Solvent Waste	750	-	-	-
4. Empty Drums	4,000	-	-	-
5. Rag Waste	7,250	7,250	7,250	1,450
TOTALS	29,000	7,250	7,250	1,450
% REDUCTIONS	--	--	0%	80%

TABLE 2-11
AFP 42: NERO AND ASSOCIATES
SUMMARY OF
CURRENT, PLANNED AND PROPOSED
WASTE MANAGEMENT METHODS

WASTE STREAM	PRESENT METHOD	PLANNED CHANGES	PROPOSED CHANGES
1. Oil Waste	Off-site reuse as fuel	None	On-site reuse as fuel
2. Jet Fuel Waste	Off-site reuse as fuel	None	On-site reuse as fuel
3. Solvent Waste	Off-site reuse as fuel	None	On-site reuse as fuel
4. Empty Drums	Off-site recon- ditioning	None	None
5. Rag Waste	Sanitary landfill	None	On-site recycle through cleaning

2.4.2 Recommendations

Based on the findings of this waste minimization investigation of Nero operations at AFP 42, the following is an inventory of recommendations made with the objectives of minimizing current waste disposal.

1. Jet Fuel and Solvent Waste

1. Evaluate on-site reuse as fuel in Nero's steam boilers.

2. Rag Waste

1. Consider on-site cleaning at a central cleaning facility in conjunction with other AFP contractors and the Air Force.

2.4.3 Economics

Table 2-12 summarizes the economics of some of the waste minimization measures developed through this investigation. Economics are order of magnitude estimates only and should not be used in place of detailed engineering estimates which consider contractor labor, engineering and administration costs and facility specific costs. Where costs were not available from Nero, estimates are based on standard cost references, vendor quotes or experience with similar capital projects.

TABLE 2-12
 APP 42: NERO AND ASSOCIATES
 POTENTIAL WASTE MINIMIZATION ECONOMICS

WASTE	OPTION	CAPITAL COST (\$)	ANNUAL O&M COST (\$/YR)	INCREASED ANNUAL SAVINGS (\$/YR)	PAYBACK (YR)
Oil, Jet Fuel and Collected Waste	On-site reuse as fuel	1,500	0	0	

2.5 CENTRALIZED RAG CLEANING

The establishment of a centralized dry cleaning facility at AFP 42 to service all AFP 42 contractors may be feasible. If so, it would result in a reduction in the amount of waste sent off-site for landfilling from all AFP 42 contractors by 240,000 lb. The establishment of such a facility is estimated to cost \$130,000. Operating costs are estimated to be \$205,000/yr. At the current cost of rag purchase and disposal for all AFP 42 contractors of \$250,000/yr, this plant would reduce rag purchase and disposal cost by \$45,000/yr and have a payback period of three years. Additionally, on-site dry cleaning would greatly reduce potential liabilities associated with land disposal of AFP 42 wastes; it would reduce the amount of wastes sent to land disposal from all of AFP 42 by 18 percent.

3.0 WASTE MINIMIZATION PROGRAM: ROCKWELL INTERNATIONAL

This section provides a description of current waste generation and management practices by waste stream at AFP 42 - Rockwell International. A summary of these current practices is provided in Table 3-1. The following subsections present detailed descriptions of each waste stream and current management methods; waste stream material balances (where appropriate); opportunities for waste minimization; system economics; and recommendations for system implementation. This information is provided in support of the conclusions and recommendations provided in Section 2. Work sheets for each waste stream are included in Appendix B.

3.1 FLAMMABLE LIQUID WASTE

3.1.1 Waste Generation and Management Practices

Flammable liquid waste generated at Rockwell includes hydraulic oils, Turco 4460, lube oils, and isopropanol (IPA). Flammable liquid waste is generated through hydraulic line flushing, equipment maintenance, and hand cleaning of aircraft parts. Flammable liquid waste is collected in drums segregated by type at the generating locations and is shipped in bulk (i.e., the drums are pumped into a tank truck) to the Oil and Solvent Process Company (OSCO) of Azusa, California, for fuel blending and reuse as cement kiln fuel.

Approximately 76,000 lb (10,200 gal) of flammable liquid waste was generated by Rockwell at AFP 42 and Rockwell's Palmdale plant in 1984; unfortunately, because wastes from the two locations are manifested together, it is not possible to determine how much of this waste was generated from Air Force property. Of this 10,200 gal, approximately 6,100 gal was hydraulic oil, 3,300 gal was methyl ethyl ketone (MEK) and 800 gal was lube oil.

Since 1984, Turco 4460 and IPA have largely or completely replaced MEK in accordance with South Coast Air Quality Management District (SCAQMD) requirements. Turco 4460 is composed of 50 percent aromatic petroleum, 20 percent methyl isobutyl ketone (MIBK), 20 percent ethyl acetate, and 10 percent IPA. The rates of generation of these wastes are expected to increase to between five and ten times the 1984 level when full production is reached.

TABLE 3-1
APP 42: ROCKWELL
WASTE GENERATION RATES AND MANAGEMENT PRACTICES

WASTE	SOURCE/CONTENT	1984 GENERATION RATE	CURRENT MANAGEMENT PRACTICES	CURRENT COSTS	CHANGES PROJECTED/COMMENTS
1. Flammable Liquid Waste	Hydraulic line flushing and part cleaning: -Hydraulic oil -Turco 4460	76,000 lb (10,200 gal)	Collected in drums Bulk transport Fuel blending at OSCO	\$3,000	Expected to increase to between 50,000 and 100,000 gal/yr at full production rate.
2. Flammable Solid Waste	Paint thinning, part cleaning, and paint gun cleaning: -Turco 4460 -Blend 1	97,000 lb (13,000 gal)	Collected in drums Solidified with vermiculite Drum transport Landfilled at Casmalia	\$47,200	Expected to increase to 22,000 gal/yr at full production rate.
3. Empty Drums	Shipping containers for chemicals used in plant	12,000 lb (300 drums)	Shipped to Casmalia Crushed and landfilled	NA	Expected to increase to 1500 drums/yr at full production rate.
4. Paint Booth Waste	Painting operations, including waterwall wash, stripping, and sanding: -99% water -Chromates	350,000 lb (42,000 gal)	Collected in pit Treated in ion exchange system Discharged to sanitary sewer	NA	Expected to increase to 70,000 gal/yr at full production rate.
5. Ion Exchange Resin Waste	Ion exchange chromium removal system	10,000 lb (825 gal)	Collected in drums Drum transport Landfilled at Casmalia	\$3,000	None
6. Diesel Fuel Waste	Fuel tank cleaning: -90% water -10% diesel fuel	25,000 lb (3,000 gal)	Collected in tank truck Bulk transport Treated at Casmalia	NA	Waste generated only once. No future generation expected.

1 Unit costs are provided in Appendix A. Costs include transport unless otherwise noted.

TABLE 3-1 (CONT'D.)
APP 42: ROCKWELL
WASTE GENERATION RATES AND MANAGEMENT PRACTICES

WASTE	SOURCE/CONTENT	1984 GENERATION RATE	CURRENT MANAGEMENT PRACTICES	CURRENT ¹ COSTS	CHANGES PROJECTED/COMMENTS
7. Regenerant Solution Waste	Deionized water system regeneration: -Hydrochloric acid -Sodium hydroxide	15,000,000 lb (1,800,000 gal)	Collected in tanks Neutralized Discharged to sanitary sewer	NA	None
8. Ammonia Waste	Surface preparation of completed airplanes	4,000 lb	Collected in drums Solidified with verm- iculite Drum transport Landfilled at Casmalia	\$1,600	None
9. Rag Waste	Hand cleaning of parts and completed aircraft	325,000 lb (1300 yd ³)	Collected in dumpsters Landfilled at Casmalia	\$65,000	Expected to increase to 2600 yd ³ at full production rate.

¹ Unit costs are provided in Appendix A. Costs include transport unless otherwise noted.

Disposal at OSCO is estimated to cost 0.30/gal¹; at current generation rates, this results in an annual disposal cost of \$3,000/yr. New aircraft hydraulic oils cost \$4.50/gal, or \$27,450/yr at 1984 use rates; Turco 4460 costs \$7.00/gal, or \$23,000/yr at 1984 generation rates.

3.1.2 Waste Minimization Opportunities

Hydraulic oil waste and Turco 4460 may be suitable for recycle. Alternatives for recycling these wastes are discussed below.

3.1.2.1 Hydraulic Oil Waste Recycling

Hydraulic fluid waste can be recycled through simple filtration if contaminated solely by particulates. Filtration followed by flash vaporization of water and solvent or by vacuum distillation can be used to recycle hydraulic oils if contaminated by water and solvent as well as particulates.

Rockwell personnel have developed and fabricated a multiple stage hydraulic oil filtration system capable of removing particulates and producing recycled oil which meets military specifications. The system uses several cartridge filters in series to remove all particulates of over 2 microns in size. However, this unit is not being used at this time, a situation which Rockwell personnel attribute to lack of incentives for recycling and rigid production specifications.

At full production, hydraulic oil use for flushing at AFP 42 and Rockwell-Palmdale is expected to be at least 1,200 gal/wk. At this rate, the use of a recycling system would result in an estimated savings of \$250,000/yr for hydraulic oil purchase costs (based on 90 percent recovery and an oil purchase cost of \$4.50/gal).

If hydraulic oils are contaminated solely with particulates, recycling could be accomplished with several units similar to the existing unit at a projected capital cost of \$5,000 per unit. If four units were required, the total capital cost would be approximately \$20,000, with estimated operating costs of \$12,000/yr (based on \$.20/gal processed). Payback would be immediate.

If waste hydraulic oils are contaminated with water and solvents, a more complex recovery unit may be required.

¹ Disposal costs include transportation unless otherwise noted.

These units include filtration and flash vaporization or vacuum distillation to remove particulates, water, and solvent. Product oil from these units may not be of satisfactory quality to meet military specifications due to residual water or solvent contamination. Therefore, bench scale testing would be required to evaluate the applicability of this technology. If suitable economic projections are favorable, four of these units costing approximately \$11,000 each should be capable of recycling the projected production volume, with operating costs of \$12,000/yr. Savings on material purchase costs would be \$250,000/yr. The payback period for the units based upon savings on purchase costs alone would be three months.

3.1.2.2 On-Site Solvent Waste Recycling

Waste Turco 4460 solvent and IPA may be recycled on-site using a small, self-contained distillation unit. However, it is probable that the Turco solvent mix recovered and IPA would not meet original specifications and therefore would not be suitable for reuse in critical part cleaning. If other non-critical uses of recovered product can be identified, however, solvent recovery may be economically feasible.

For example, at a projected rate of production of waste Turco 4460 of 15,000 gal/yr at full aircraft production rate (assuming that 90 percent of MEK use was replaced with Turco 4460 and full rate usage is five times 1984 usage), Turco purchase costs would be roughly \$105,000/yr. If 10 percent of Turco use was for non-critical tool and equipment cleaning for which recycled material would be appropriate, the annual savings on solvent purchase would be \$10,500/yr. Purchase and installation of a small unit to recover this volume would cost approximately \$7000; operation would cost \$300/yr (based on costs of \$0.20/gal). Therefore, unit payback would be eight months.

3.1.2.3 On-Site Reuse as Fuel

Hydraulic oil and solvent waste that can not be satisfactorily recycled through the methods discussed above may be able to be reused on-site as fuel in Rockwell's gas/oil fired boilers if the chlorine content of these wastes is small, i.e., in the part per million (ppm) range. Waste can be mixed with fuel oil to be burned in the boilers at no cost. Alternately, because the boilers are normally fired with gas unless gas service is interrupted, waste may be able to be injected into one boiler through an existing oil nozzle at a low feed rate as a secondary fuel while gas is used as the primary fuel. In this case, a small cost would

be involved for installing a small feed tank. The estimated cost for installing a tank and piping is \$2,500. At a 15,000 gal/yr waste generation rate, the savings on waste disposal costs would be \$3000/yr and the payback period on the modification would be 10 months.

On-site burning of waste as fuel and storage of waste fuel in fuel tanks is currently exempted from regulation under California law. However, on January 1, 1986, the regulatory status of this practice will change and requirements that may be placed on it are uncertain. If permitting or other restrictive requirements were to be required under the new rules, on-site burning would not be an economically feasible recycling. For example, if an incinerator permit is required for this activity under new regulations, the estimated cost of obtaining a permit (similar to a RCRA incinerator permit) would be \$200,000; additionally, operating costs would be significant due to monitoring and analytical requirements. The benefits of on-site reuse as fuel would not be large enough to justify this expense.

3.1.2.4 Off-Site Hydraulic Oil and Solvent Recycling

Hydraulic oil and solvent waste may be recycled off-site for reuse as oil and solvent because these wastes are segregated by type when generated (mixed oils and solvents are much more difficult to separate). While these wastes are currently reused as fuel off-site, Rockwell may be able to obtain revenues for these wastes from a recycler who intends to sell recycled product rather than burn the waste for its heat value.

3.1.3 Recommendations

Rockwell should institute a recycling program for particulate contaminated hydraulic oils using their existing equipment and additional units similar to this equipment as necessary. If some hydraulic oil waste is contaminated with water or solvents not amenable to removal by filtration, Rockwell should evaluate recycling these materials on-site using appropriate recycling units.

The initial step in evaluating on-site recycling of water or solvent contaminated oils would be to bench test available systems on Rockwell oil to determine if recycled product quality is satisfactory. Bench scale testing may be done by the manufacturer using a sample submitted by Rockwell, or may be done on-site using a system loaned by the vendor for test purposes. If product quality is acceptable for reuse, Rockwell should implement on-site recycling of these oils as well as particulate contaminated oils.

Rockwell should also evaluate on-site recycling of solvents. To evaluate reuse of these materials, Rockwell should first perform a bench scale test of distilling their solvent

wastes (Turco 4460 and others) to determine recycled product quality. Rockwell should then determine if there are sufficient uses for the recovered material within the plant to justify recovery.

For waste which can not be satisfactorily recycled through these means, it is recommended that Rockwell investigate the possibility of recycling these wastes off-site for reuse as oil and solvent. If no facility is found to recycle these wastes, Rockwell should continue its current disposal practice until new California regulations are issued in January, 1986, governing waste reuse as fuel. At that time, Rockwell should review these requirements to determine if they effectively prohibit on-site burning of waste oil as fuel through implementation of a restrictive permit system or through other requirements. If not, Rockwell should dispose of these wastes on-site through reuse as fuel.

3.2 FLAMMABLE SOLID WASTE

3.2.1 Waste Generation and Management Practices

Flammable solid waste is generated at Rockwell through the addition of vermiculite to flammable solvent waste and paint thinners used in paint shops. In the past, these solvents and thinners have consisted of MEK, acetone, hydraulic oil and polyurethane paint solvents. Due to recent changes in SCAQMD regulations, MEK and acetone are no longer used and have largely been replaced with Turco 4460 solvent (for thinning and hand cleaning) and Van Waters and Rogers Blend 1 (for spray gun cleaning). The composition of Turco 4460 has been provided in Section 3.1.1; Blend 1 is a mixture of aromatic naptha, ethyl acetate, MEK, and IPA. Wastes are collected in drums segregated by solvent type in the paint shop. Vermiculite is added as solvents are added to the drums.

Solidified solvent waste and thinner is stored in drums and shipped in drums for disposal by landfilling at Casmalia Resources in Casmalia, California. At current production rates, Turco 4460 waste is generated at a rate of 52,000 lb (7,000 gal/yr); Blend 1 waste is generated at a rate of about 45,000 lb (6,000 gal/yr). At full production rate, it is expected that thinner and solvent waste will be generated at a rate of 164,000 lb (22,000 gal/yr).

Disposal of solidified flammable waste costs \$200/drum, or approximately \$47,200/yr. At full production rate, this cost is expected to increase to \$80,000/yr.

3.2.2 Waste Minimization Opportunities

Similar to the flammable liquid waste discussed in Section 3.1.2, flammable solid waste may be recovered on-site through distillation, if they are no longer solidified with vermiculite. However, because these wastes contain paint pigments and are mixtures of solvents, it is not likely that the recovered product would be able to be used for critical hand cleaning or painting applications. Recovered Blend 1 may, however, be suitable for paint gun cleaning.

If recovered Blend 1 could be used for paint gun cleaning, it could reduce new Blend 1 purchase from 10,000 gal/yr at projected rates to 5300 gal/yr (assuming solvent can only be recycled once before the solvent blend is too far out of specification for reuse, and a 90 percent recovery efficiency). This would result in a savings for solvent purchase costs of \$14,100/yr (4700 gal at \$3.00/gal) and for solvent disposal costs of \$15,000/yr (75 drums at \$200/drum). At a recycling unit purchase and installation cost of \$13,500, this would result in a payback period of six months.

Alternatively, this waste may be suitable for off-site recycling. Van Waters and Rogers recycles their product solvents and may accept waste Blend 1 for recycling. Additionally, OSCO or other recyclers may recover Turco 4460 and Blend 1. However, solvent recyclers may not accept pigmented solvents for recycling because pigments may damage recycling stills or produce a product of unacceptable quality.

If on-site and off-site recycling are not feasible, flammable solvents can be sent off-site for reuse as fuel through fuel blending. OSCO and Systech of Torrance, California both perform fuel blending to produce cement kiln fuels; Systech accepts pigmented waste for reuse as cement kiln fuel.

Finally, if none of these alternatives is feasible, Rockwell should dispose of this waste through incineration rather than through the current practice of landfilling. Incineration will minimize potential future liabilities associated with land disposal by assuring that wastes are destroyed.

3.2.3 Recommendations

Rockwell should evaluate on-site recycling of flammable solvent waste which is currently solidified. To evaluate

reuse of these materials, Rockwell should first perform a bench scale test to determine product quality. Rockwell should then determine if there are sufficient uses for recycled solvent and thinner to justify recovery.

If on-site recovery is not feasible, Rockwell should investigate off-site recycling of this waste through distillation or fuel blending. At a minimum, all solvents should be able to be reused through full blending; if not, they should be incinerated rather than disposed of by landfilling. Solidification of this waste with vermiculite followed by land disposal should be ceased to avoid associated liabilities.

3.3 EMPTY DRUMS

3.3.1 Waste Generation and Management Practices

Waste empty drums are generated at Rockwell through use of drum contents. Waste drums are collected, stored, and shipped to Casmalia for crushing and landfilling. Empty drums disposed of in this manner are drums which have typically contained non-chlorinated solvents, lube oils, and hydraulic fluids.

Approximately 300 empty drums/yr (12,000 lb) are currently generated at Rockwell. This number should increase significantly when full production is achieved; it is estimated that it will increase to 1500 drums/yr. Disposal costs were not available for empty drums.

3.3.2 Waste Minimization Opportunities

Waste drums can be recycled off-site through sale to a drum reconditioner. Currently, drum reconditioners in California are operating on an interim basis without hazardous waste facility permits under close oversight by the California Department of Health Services (DOHS). As part of this oversight, DOHS must approve shipments to recyclers and provide a variance to manifesting requirements because recyclers are not permitted facilities. Based upon the nature of the materials which come in drums emptied at Rockwell and discussions with John Masterman of DOHS, reconditioning of these drums at an off-site facility would probably be allowed by DOHS. Typically, \$3 to \$6/drum is paid by reconditioners to generators for a full shipment of drums (150). Therefore, off-site recycling would generate \$900 to \$1,800/yr in revenues at current waste generation rates, and \$4,500 to \$9,000/yr at projected generation rates. Additional savings over current disposal costs would also be realized.

3.3.3 Recommendations

It is recommended that Rockwell evaluate off-site recycling of empty drums. Rockwell should contact DOHS to identify reconditioners operating under state oversight and to verify that the drums generated are suitable for reconditioning based upon their former contents. Rockwell should also inspect any reconditioner who it considers using for drum recycling prior to shipping drums to the facility to determine if the reconditioner is operating in a satisfactory manner.

3.4 PAINT BOOTH WASTE

Paint booth waste consists of a combination of waste materials generated during surface preparation, painting, and stripping activities. This waste includes water and entrained paint from waterwall paint booth sumps; water and chromate paint dust from primer sanding; and water, chromate paint, and paint stripper from occasional stripping of small parts. These wastes are collected in a central sump and tested for chrome content. If the wastewater contains over 7 ppm of chromium, it is treated in a bottle ion exchange system for chromium removal and then discharged to the plant wastewater treatment system. If it contains less than 7 ppm chromium, it is discharged to the plant wastewater treatment system without ion exchange.

Paint booth waste is typically over 99 percent water with small amounts of chromates and organics (methylene chloride and phenol) from stripping operations. Approximately 350,000 lb (42,000 gal/yr) of paint booth waste was generated at Rockwell in 1984. During 1984, paint booth waste was sent to Casmalia in bulk for disposal because the ion exchange system was under renovation; this waste is now being treated on-site as discussed above. Paint booth waste generation is expected to increase to 70,000 gal/yr in 1985 when full production is achieved.

Current on-site treatment is an effective means for reducing the hazard of this waste and minimizing the amount of hazardous paint booth waste sent off-site for disposal. No opportunities for further minimizing generation of this waste were identified.

3.5 ION EXCHANGE RESIN WASTE

3.5.1 Waste Generation and Management Practices

Ion exchange resin waste is generated by periodic replacement of saturated cationic exchange resin in the chromium removal system with fresh resin. The resin waste is drummed and shipped in drums for landfill disposal at Casmalia. Resin waste consists of the resin matrix and adsorbed chromium. Resin waste is generated at a rate of 5 drums/4 months, or 10,000 lb (825 gal/yr). Disposal at Casmalia costs \$200/drum, or \$3,000/yr.

3.5.2 Waste Minimization Opportunities

Saturated cationic exchange resins can be regenerated using acid solutions for reuse. Although Calgon (which services the ion exchange units) apparently does not want the saturated resin, other water treatment or softening services in the area may be willing to purchase this resin for reuse. Due to the small size of the system and small flow rate, on-site recycling for reuse is not suitable.

3.5.3 Recommendations

It is recommended that Rockwell investigate resale of saturated ion exchange resins to local water softener or water treatment services. If no services are found to purchase this material, the current disposal practice should be continued.

3.6 DIESEL FUEL WASTE

Diesel fuel waste (contaminated with water) was generated during cleanout of diesel fuel tanks during 1984. Diesel fuel and water were pumped from the fuel tank to a vacuum truck and bulk transported to Casmalia for disposal by treatment. Diesel fuel waste was composed of approximately 90 percent water and 10 percent fuel oil. Approximately 25,000 lb (3,000 gal) of this waste was generated in 1984. Disposal costs were not available for this waste. No opportunities for minimizing this waste were identified because it is not expected to be generated again in the foreseeable future.

3.7 REGENERANT SOLUTION WASTE

Regenerant solution waste consists of waste hydrochloric acid and sodium hydroxide used to regenerate the mixed ion exchange resin in Rockwell's deionized water system. The waste acid and caustic regenerant solutions are pumped from the deionizing system to a common 5,000 gallon tank where they neutralize each other to produce a neutral pH solution. The pH of the mixed solution is checked and acid or caustic is added if necessary to complete neutralization. The neutralized solution is then discharged to the AFP 42 wastewater treatment plant for disposal.

Approximately 15 million lb (1.8 million gal/yr) of regenerant solution is produced at Rockwell. Additionally, in 1984, a failure of the hydrochloric acid storage tank resulted in the production of 3,600 lb of solidified acid solution which was disposed of by landfilling at Casmalia; further generation of solidified acid solution waste is not anticipated.

The current system for treatment of waste regenerant solution at Rockwell effectively minimizes the hazardous nature of this waste. No opportunities for further minimization of this waste stream were identified.

3.8 AMMONIA WASTE

3.8.1 Waste Generation and Management Practices

Ammonia solution waste is generated during surface preparation of completed aircraft prior to painting. Completed aircraft are wiped with ammonia solution, wiped with alodine, and then painted. Ammonia solution waste is collected in drums, solidified through addition of adsorbent, and shipped in drums for landfilling at Casmalia.

Approximately 4,000 lb of solidified ammonia waste was generated in 1984. Disposal cost for this waste was \$200/drum, resulting in a total annual disposal cost for this waste of \$1,600. Projected generation at full production is 20,000 lb/yr; disposal costs would then be \$8000/yr.

3.8.2 Waste Minimization Opportunities

Ammonia solution waste should be able to be treated at an off-site industrial waste treatment facility. This would reduce the potential liability associated with disposal of this waste by substituting destruction through treatment for the current practice of land disposal. Additionally,

treatment may be considerably less expensive than land disposal; typically, industrial waste treatment costs \$1.00/gal or less, and could therefore result in a savings of \$1,160 or more. Based upon preliminary contacts, the IT Corporation facility in Martinez, California accepts high strength ammonia waste for treatment; other facilities in California may accept this waste as well.

3.8.3 Recommendations

Rockwell should investigate disposal of this waste through off-site treatment at an industrial waste treatment facility. This will involve contacting prospective facilities and submitting waste samples for bench scale testing to determine if the waste is amenable to treatment. If disposal through treatment is found to be feasible, Rockwell should change from the current practice of land disposal to treatment.

3.9 RAG WASTE

3.9.1 Waste Generation and Management Practices

Rag waste is generated at Rockwell through hand cleaning of aircraft parts and assembled aircraft, application of alodine solution, and paint clean-up. Rags are collected in small containers throughout production areas and are then transferred to dumpsters. Rag waste is shipped in roll-off containers to Casmalia for landfilling.

Approximately 325,000 lb (1300 yd³/yr) of rag waste is generated at Rockwell. This generation rate is expected to increase to at least 50 yd³/wk when production reaches full rate. At the current disposal cost of \$50/yd³, rag disposal costs \$65,000/yr at the current production rate. At full production, disposal should cost approximately \$130,000/yr.

3.9.2 Waste Minimization Opportunities

Rag waste can be minimized through recycling by dry cleaning. As industrial dry cleaning services are not available off-site, a central on-site facility for dry cleaning rags from all AFP 42 contractors may be justified. The establishment of such a centralized dry cleaning plant at AFP 42 is discussed in Section 7.2 of this report.

3.9.3 Recommendations

Recommendations regarding minimization of rag waste are discussed in Section 7.3 of this report.

4.0 WASTE MINIMIZATION PROGRAM: NORTHROP

This section provides a description of current waste generation and management practices by waste stream at AFP 42 - Northrop. A summary of these current practices is provided in Table 4-1. The following subsections present detailed descriptions of each waste stream and current management methods; waste stream material balances (where appropriate); opportunities for waste minimization; system economics; and recommendations for system implementation. This information is provided in support of the conclusions and recommendations provided in Section 2. Work sheets for each waste stream are included in Appendix C.

4.1 THINNING COMPOUND WASTE

4.1.1. Waste Generation and Management Practices

Thinning compound waste is generated in painting operations at Northrop. Thinning compounds are used in the paint shop for cleaning parts before painting, paint thinning, and paint clean-up. Thinner waste is drummed in the paint shop in drums segregated by type, stored on-site, and then shipped to Northrop-Hawthorne, in Hawthorne, California. At Hawthorne, the various thinners used by Northrop are consolidated in tanks for bulk shipment to Systech in Torrance, California for fuel blending and reuse as cement kiln fuel.

Approximately 10,700 lb (1400 gal) of thinner waste is generated at Northrop annually. Prior to January, 1985, the thinners used at Northrop were primarily methyl ethyl ketone (MEK) and acetone; 90 percent of the thinning waste produced was MEK and 6 percent was acetone. In January, 1985, use of MEK and other volatile chemicals for paint thinning ceased at Northrop in order to meet California South Coast Air Quality Management District (SCAQMD) regulations on volatile organic carbon emissions. Since that time, thinning compounds used have been primarily Turco 4460 (for part cleaning and thinning) and Turco-Lock for gun cleaning. Turco 4460 waste is composed of 50 percent aromatic petroleum, 20 percent ethyl acetate, 20 percent methyl isobutyl ketone (MIBK), and 10 percent isopropanol (IPA). Turco-Lock waste is composed of 50 percent 1,1,1-trichloroethane (TCA) and 50 percent methylene chloride.

Approximately 1000 gal of Turco 4460 waste is now being generated annually at Northrop. This waste is flammable and has continued to be disposed of at Systech through fuel blending, at a cost of \$0.51/gal¹, for a total annual cost of off-site reuse of \$475.

1 Disposal costs include transportation, including transportation from Palmdale to Hawthorne, unless otherwise noted.

TABLE 4-1
APP 42: NORTHROP
WASTE GENERATION RATES AND MANAGEMENT PRACTICES

WASTE	SOURCE/CONTENT	1984 GENERATION RATE	CURRENT MANAGEMENT PRACTICES	CURRENT ¹ COSTS	CHANGES PROJECTED/COMMENTS
1. Thinning Com- pound Waste	Paint thinning and part cleaning: -50% methylene chloride, 50% TCA -50% aromatic petroleum 20% ethyl acetate, 20% MIBK, and 10% IPA	10,720 lb (11400 gal)	Collected in drums Drum transport Bulk consolidation Bulk transport Fuel blending at Systech	\$875	None
2. Flammable Solvent Waste	Hand cleaning aircraft parts: -Standard solvent -Naphtha -IPA -Cellosolve acetate	3,080 lb (440 gal)	Collected in drums Drum transport Bulk consolidation Bulk transport Fuel blending at Systech	\$225	None
3. Jet Fuel Waste	Fuel tank maintenance: -99% JP-4 -1% water and other contaminants	11,560 lb (11700 gal)	Collected in drums Drum transport Bulk consolidation Bulk transport Fuel blending at Systech	\$870	None
4. Paint Waste	Painting operations: -Pigment -Thinner - 50% aromatic petroleum, 20% ethyl acetate, 20% MIBK, and 10% IPA	9,450 lb (11,350 gal)	Collected in drums Drum transport Bulk consolidation Bulk transport Fuel blending at Systech	\$700	None
5. Paint Booth Waste	Cleanout of waterwall sumps: -Water -Paint chips -Surfactant	3,750 lb (450 gal)	Collected in drums Drum transport Landfilled at Casmaia	\$500	None
6. Hydraulic Oil Waste	Maintenance of aircraft hydraulic lines	5,500 lb (825 gal)	Collected in drums Drum transport Bulk consolidation Bulk transport Fuel blending at Systech	\$420	None

1 Unit costs are provided in Appendix A. Costs include transport unless otherwise noted.

TABLE 4-1
APP 42: NORTHROP
WASTE GENERATION RATES AND MANAGEMENT PRACTICES

WASTE	SOURCE/CONTENT	1984 GENERATION RATE	CURRENT MANAGEMENT PRACTICES	CURRENT COSTS	CHANGES PROPOSED/COMMENTS
7. Fuel Oil Waste	Tank cleaning: -No. 2 fuel oil -Water	9,170 lb (1010 gal)	Collected in drums (high oil content) or bulk (high water content). High oil content waste shipped to Systech for fuel blending. High water content waste shipped in bulk to HMK for land disposal.	NA	waste generated only once. No future generation
8. Rag Waste	Hand cleaning parts and equipment	1700 lb (7 yd ³)	Collected in drums Drum transport Landfilled at Caswellia	\$1600	generated expected to in- crease to 2500 lbs

1 Unit costs are provided in Appendix A. Costs include transport unless otherwise noted.

Approximately 800 gallons of Turco-Lock waste is now generated annually at Northrop at AFP 42. Appropriate methods for reuse or disposal of this material are currently under evaluation by Northrop. In particular, Northrop is currently evaluating recovery through distillation at Northrop-Hawthorne. If recovery is not feasible (e.g., due to the formation of a methylene chloride - TCA azeotrope), this material will probably be disposed of through incineration at Systech by blending with non-halogenated organics to achieve a waste blend containing less than 4 percent chlorine, which is Systech's cutoff level for chlorine. The estimated cost for disposal through incineration is \$400/yr. Total annual cost for disposal of all thinners through off-site reuse as fuel or incineration is therefore estimated to be \$875.

4.1.2 Waste Minimization Opportunities

Solvent waste may be recycled through several means as discussed below.

4.1.2.1 On-Site Solvent Waste Recycling

Non-chlorinated solvent waste (Turco 4460) may be recycled on-site through distillation in a small commercially available packaged unit. Because this solvent is a blend of materials, some with similar boiling ranges, recycled product may not be suitable for hand cleaning of aircraft parts. In this case, on-site recycling would not be suitable because there are few uses for solvent other than aircraft part cleaning at Northrop. If recycled Turco was acceptable for reuse, the savings in material purchase cost would be \$6300/yr (based on a purchase price of \$7.00/gal and 90 percent recovery) and the savings in disposal cost would be \$400/yr. Small distillation units typically cost \$7,000 installed and \$0.20/gal to operate; the payback period for such a unit would therefore be 13 months.

4.1.2.2 On-Site Reuse as Fuel

If recycling is not feasible, non-chlorinated thinner waste which does not contain paints may be reused on-site as fuel in Northrop's gas/oil-fired boilers. Wastes can be mixed with fuel oil in existing tanks to be burned in the boilers at no cost. Alternately, because the boilers at Northrop are normally fired with gas unless gas service is interrupted, wastes may be able to be injected into the boiler through an existing oil nozzle at a low feed rate as a secondary fuel while gas is used as the primary fuel. In this case a small cost would be incurred for installing a small feed tank. The estimated cost for installing a small tank and piping is \$1500. At the current waste disposal rate of 1000 gal/yr and off-site disposal cost of \$500/yr, the payback period for this installation would be three years.

Under current California hazardous waste law, burning hazardous waste as fuel is exempt from regulation; additionally, storage prior to burning is also exempt, so no additional permits are needed for this activity. However, on January 1, 1986, burning hazardous waste as fuel will no longer be exempt from regulation and the regulatory requirements that may be placed on this activity are uncertain. If permitting were to be required or other restrictive regulations are imposed, on-site reuse as fuel would not be justifiable due to the relatively small volume of wastes generated. For example, if an incinerator permit is required for this activity under new regulations, the estimated cost of obtaining a permit would be approximately \$200,000; additionally, operating costs would be significant due to monitoring and analytical requirements. The benefits of on-site reuse as fuel are not sufficient to justify such a cost.

4.1.2.3 Off-Site Recycling

Solvent waste may be recycled off-site for reuse as solvent if solvents are kept segregated by type (mixed solvents are much more difficult to separate than segregated solvent wastes). While this waste is currently reused as fuel off-site, Northrop may obtain revenues for this waste from a recycler who intends to sell recycled product rather than burn the waste for its heat value.

4.1.3 Recommendations

It is recommended that Northrop evaluate the feasibility of on-site recovery of Turco 4460 in a small distillation unit. This evaluation should involve a bench scale test on a batch of Northrop's solvent waste in order to determine the quality of recovered product. Bench testing may either be done by the equipment manufacturer on a waste sample submitted by Northrop, or by use on-site of a test still provided by the manufacturer.

If on-site distillation is not feasible, it is recommended that Northrop investigate the possibility of recycling waste off-site for reuse as solvent. If no facility is found to recycle this waste, Northrop should continue off-site reuse of these wastes as fuel until new California regulations are issued governing waste reuse as fuel in 1986. At that time, Northrop should review these requirements to determine if they effectively prohibit on-site burning of non-chlorinated waste thinners as fuel through implementation of a restrictive permit system or through other requirements. If not, Northrop should dispose of this waste on-site through reuse as fuel.

It is recommended that Northrop determine if recovery of Turco-Lock waste through distillation is feasible. If feasible, Northrop should proceed with recycling of this waste at Hawthorne. If not feasible, it is recommended that Northrop continue off-site incineration through fuel blending.

4.2 FLAMMABLE SOLVENT WASTE

Flammable solvents are used at Northrop for hand cleaning aircraft parts, cleaning fuel and engine lines (naptha), and cleaning equipment. Flammable solvent waste is collected in drums in satellite storage areas, stored, and shipped to Northrop-Hawthorne for consolidation and bulk storage. This waste is then shipped in bulk to Systech for reuse through fuel blending.

Flammable solvent waste is composed of a mixture of Stoddard solvent, IPA, cellosolve acetate, acetone, naptha and other solvents. Approximately 3,080 lb (440 gal) of flammable solvent waste is generated at Northrop annually. Reuse through fuel blending at Systech costs \$0.51/gal, resulting in an annual off-site reuse cost of \$225/yr.

Other than possible reuse as fuel on-site, as discussed for thinning compounds in section 4.1.2.2, no further opportunities for minimizing this waste were identified. Off-site recycling of this waste for solvent recovery is not feasible due to the very small volume of the individual solvents composing this waste. Recommendations made for on-site reuse as fuel for thinning compounds in section 4.1.3 also apply to this waste.

4.3 JET FUEL WASTE

4.3.1 Waste Generation and Management Practices

JP-4 waste is generated at Northrop during fuel tank maintenance. JP-4 waste is stored in drums, shipped to Northrop-Hawthorne, bulk stored, and shipped in bulk to Systech for reuse through fuel blending. JP-4 waste is over 99 percent fuel with minor amounts of contamination.

Approximately 11,560 lb (1700 gal/yr) of jet fuel waste is generated at Northrop. Recycling at Systech costs \$0.51/gal, resulting in a total annual off-site recycling cost of \$870.

4.3.2 Waste Minimization Opportunities

JP-4 waste may be recycled off-site by an oil refiner for production of aviation fuel. Recycling to produce jet fuel may provide greater revenue to Northrop than the current practice of off-site fuel blending to produce cement kiln fuel.

Alternately, JP-4 waste could be reused on-site in Northrop's boilers as discussed for waste thinners in Section 4.1.2.2. This would produce a savings of \$870/yr in off-site management costs.

4.3.3 Recommendations

Northrop should investigate the possibility of recycling JP-4 waste off-site at a refinery to produce aviation fuel. If no facility is found to provide this service, Northrop should apply the recommendations made for on-site use as fuel of waste thinners in section 4.1.3 to this waste as well.

4.4 PAINT WASTE

Paint waste is generated during painting operations at Northrop. Paint waste is collected in drums, stored, shipped to Northrop-Hawthorne, bulk stored with other flammable waste, and shipped in bulk to Systech for recycling through fuel blending.

Paint waste consists of lacquers and polyurethane paints mixed with thinners such as Turco 4460. Paint waste is generated at a rate of 9,450 lb (1350 gal/yr) and are disposed at Systech at a cost of \$0.51/gal, resulting in an annual disposal cost of \$675. Current off-site recycling of this waste through fuel blending is a cost-effective means of reducing land disposal; no further opportunities for waste minimization were identified for this waste.

4.5 PAINT BOOTH WASTE

Paint booth waste is generated during cleanout of the waterwall paint booths sump at Northrop. This waste is collected in drums, shipped to Northrop-Hawthorne, and then shipped to Casmalia Resources in Casmalia, California for landfilling. Paint booth waste is mostly water with paint sludge and surfactant; 3,750 lb (450 gal/yr) of this waste is generated at Northrop. Disposal at Casmalia costs \$62/drum, resulting in an annual disposal cost of \$500. No opportunities for minimizing this waste were identified.

4.6 HYDRAULIC OIL WASTE

4.6.1 Waste Generation and Management Practices

Hydraulic oil waste is generated during maintenance of aircraft hydraulic lines. It is collected in drums, stored, shipped to Northrop-Hawthorne, bulk stored, and bulk transported to Systech for fuel blending and reuse as cement kiln fuel.

Hydraulic oil waste is 99 percent hydraulic oil with some particulate and water contamination. It is generated at a rate of 825 gal/yr, and is reused at Systech at a cost of \$0.51/gal, or \$420/yr.

4.6.2 Waste Minimization Opportunities

Waste contaminated hydraulic oils may be recycled on-site for reuse in aircraft hydraulic systems. Recycling systems are available which can remove particulates, water, and chlorine contaminants from hydraulic oils under vacuum. These units combine filtration systems for particulate removal and vacuum systems for water and chlorinated solvent removal to achieve hydraulic oil clean-up. They typically require several cycles to produce a recycled oil of satisfactory quality for most applications. However, these units may not be able to remove chlorinated solvents to a sufficient degree to allow reuse of the recovered hydraulic oil in aircraft hydraulic systems. Therefore, bench testing of the process on Northrop hydraulic oil would be required to evaluate process ability to meet recycled product quality requirements.

Small portable recycling units cost approximately \$9,000 and would also require the purchase of a small tank, for a total cost of approximately \$11,000. If such a system can produce a satisfactory product, it would result in savings of \$3340/yr in purchase cost (based on 90 percent recovery efficiency and a purchase cost of \$4.50/gal) and \$380/yr for disposal, with a \$160/yr operating cost (\$0.20/gal processed), for a total savings of \$3550/yr. The payback period would therefore be three years.

Alternately, if such a system is not able to satisfactorily recycle these waste oils, they may be reused on-site as fuel as discussed for thinners in section 4.1.2.2.

4.6.3 Recommendations

It is recommended that Northrop evaluate on-site recycling of contaminated hydraulic oil waste. The initial step in evaluating on-site recycling should be to bench test available systems on Northrop oil to determine if recycled product quality is satisfactory. Bench scale testing may be done by the manufacturer using a sample submitted by Northrop, or may be done on-site using a system loaned by the vendor for test purposes. If product quality is acceptable for reuse, Northrop should implement on-site recycling. Should product quality

not be acceptable for reuse in hydraulic systems, Northrop should consider reuse as fuel. If so, recommendations made for thinning compounds concerning on-site reuse as fuel in section 4.1.3 would also apply to this waste.

4.7 FUEL OIL WASTE

Mixed fuel oil and water waste has been generated once at Northrop during the cleaning of a No. 2 fuel oil storage tank. Approximately 990 lb (110 gal) of a 90 percent fuel oil, 10 percent water mixture was generated and sent to Systech for recycling through fuel blending at a cost of \$56. Approximately 8,100 lb (900 gal) of a 20 percent fuel oil, 80 percent water mixture were generated and shipped in bulk to the BKK Sanitary Landfill in West Covina, CA for land disposal. The cost for disposal of this waste was not available. No opportunities for minimizing this waste were identified because it is not expected to be generated again in the foreseeable future.

4.8 RAG WASTE

4.8.1 Waste Generation and Management Practices

Rag waste is generated during hand cleaning of parts and equipment. Rag waste is collected in safety cans where generated, transferred to drums, stored, transported in drums to Northrop-Hawthorne, and then shipped in drums to Casmalia for disposal. Approximately 1700 lb (7 yd³) of rag waste was generated in 1984; 2500 lb (10 yd³) of rags are projected to be generated in 1985.

Rag waste is contaminated with solvents used in cleaning, such as IPA, Stoddard solvent, and naptha. Waste disposal at Casmalia costs \$62/drum, or \$1600 in 1984 and a projected cost of \$2400 in 1985.

4.8.2 Waste Minimization Opportunities

Rag waste can be minimized through recycling by dry cleaning. As industrial dry cleaning services are not available off-site, a central on-site facility for dry cleaning rags from all AFP 42 contractors may be justified. The establishment of such a centralized dry cleaning plant at AFP 42 is discussed in Section 7.2 of this report.

4.8.3 Recommendations

Recommendations regarding minimization of rag waste are discussed in Section 7.3 of this report.

5.0 WASTE MINIMIZATION PROGRAM: LOCKHEED ADP

This section provides a description of current waste generation and management practices by waste stream at AFP 42 - Lockheed. A summary of these current practices is provided in Table 5-1. The following subsections present detailed descriptions of each waste stream and current management methods; waste stream material balances (where appropriate); opportunities for waste minimization; system economics; and recommendations for system implementation. This information is provided in support of the conclusions and recommendations provided in Section 2. Work sheets for each waste stream are included in Appendix D.

5.1 PAINT STRIPPER WASTE

5.1.1 Waste Generation and Management Practices

Paint stripper waste is generated during the stripping of parts and whole planes in Building 211 at Lockheed. After stripper (primarily Turco 5873) is applied, the paint and stripper is washed from the parts or plane and the paint, stripper and rinsewater flows to floor drains which empty into a 3,000 gal underground storage tank. During airplane stripping, two hoses are kept running in the shop as a safety procedure to allow immediate rinsing in the event of skin contact with stripper; water from these hoses also flows to the floor drains and into the underground storage tank. Roof drains from the building drain to this tank as well.

Paint stripper waste and sludges are removed from the underground tank by vacuum truck and shipped to Casmalia Resources in Casmalia, CA for disposal. Disposal is accomplished by first solidifying the waste with fly ash or cement and then landfilling the solidified product. The paint stripper waste is approximately 95 percent water contaminated with xylene, toluene, toluene diisocyanate, complex hydrocarbons, and various metals, all typically present at levels less than 1000 ppm.

Approximately 1.18 million lb (140,000 gal) of paint stripper waste is generated annually at Lockheed. Paint stripper waste transportation and disposal costs \$1400/3000 gal truckload, or \$65,000/yr¹. The rate of generation of this waste is expected to increase significantly in 1986 due to planned increases in stripping activity. Currently, approximately one plane and various amounts of miscellaneous parts are stripped per month; this rate is planned to increase to five planes per month, which will probably increase waste generation to three to five times its current level (to between 420,000 and 700,000 gal/yr).

¹ All costs given for disposal include transportation unless otherwise noted.

TABLE 5-1
APP 42 - LOCKHEED
WASTE GENERATION RATES AND MANAGEMENT PRACTICES

WASTE	SOURCE/CONTENT	1984 GENERATION RATE	CURRENT ¹ MANAGEMENT PRACTICES	CURRENT* COSTS	CHANGES PROJECTED/COMMENTS
1. Paint stripper Waste	Parts and aircraft stripping in Building 211: -Water-95% -Xylene -Toluene -Toluene diisocyanate -Metals	1,180,200 lb (140,000 gal)	Collected in underground tank Bulk transport Solidification with fly ash/concrete Landfill by Casmalia	\$65,000	Increased generation due to increased stripping. Gen- eration should increase to between 3 and 5 times the current level.
2. Fuel Waste	Water spray during fuel- ing and defueling; runway washdown: -Water-95% -JP-7 -JPTS	379,400 lb (45,000 gal)	Collected in holding tank Bulk transport Off-site recycled by Newhall Refinery	N/A	None
3. Hydraulic Oil Waste	Aircraft maintenance and assembly	15,200 lb (1800 gal)	Collected in drums Shipped to Lockheed- Burbank Bulk storage Bulk transport Recycling by Asberry Oil	N/A	None
4. Solvent Waste	Aircraft maintenance and assembly: -Trichloroethane -Isopropanol -Methyl ethyl ketone	8,000 lb (950 gal)	Collected in drums Shipped to Lockheed- Burbank Bulk storage Bulk transport Fuel blending by OSCO	\$700	None
5. Rag Waste	Aircraft maintenance and assembly: -Alodine 1200, 1000, and 600 -Trichloroethane	40,750 lb (163 yd ³) Bulk transport	Collected in dumpsters Bulk transport Landfill by Casmalia	\$30,500	None

1 Unit costs are provided in Appendix A. All costs include transportation unless otherwise noted.

5.1.2 Waste Minimization Opportunities

Paint stripper waste at Lockheed can be reduced significantly through improved water management. In particular, clean water (e.g., rainwater and safety water) should be segregated from stripping rinsewaters. This can be accomplished through the following means.

As part of the currently planned replacement of the 3,000 gal underground storage tank with a 10,000 gal tank with secondary containment, Lockheed should reroute the roof drains for Building 211 to drain onto the paved area around the building or to storm drainage ditches. The roof drains currently drain a roof area of 30,000 ft² and collect an estimated 150,000 gal of rainwater per year (at an average annual precipitation of 8 inches). Therefore, rerouting this runoff will significantly reduce the volume of waste generated. For example, if only 50 percent of incident rainfall currently reaches the tank as roof runoff, this change would reduce waste generation by 75,000 gal/yr and save roughly \$35,000/yr. The incremental cost for rerouting the roof drains in conjunction with the already planned tank replacement is estimated to be less than \$2000.

An alternative means should be implemented for handling safety water during stripping. The current system of continuously running two hoses produces roughly 60 gal/hr of wastewater when in use. One alternative that would reduce the amount of wastewater generated is to use trigger-handled nozzles on the hoses. These would allow the hoses to be pressurized and readily available without having them continuously flowing. If a constant flow is determined to be necessary, a second alternative would be to use a separate collection system for the safety water. If safety water is in use eight hours per week at the current production rate of one plane/month, use of one of these alternatives would reduce waste generation by 25,000 gal/yr, at a savings of \$12,000/yr. Cost for implementing would be minimal (less than \$50). At the planned production rate of five planes per month, use of one of the alternatives would reduce projected waste generation by 100,000 gal/yr and save \$46,600 (based on an increase in safety water use to 40 hours per week).

Finally, the paint stripping wastewaters that are generated should be able to be treated off-site at an industrial waste treatment facility, rather than being solidified and landfilled. Treatment would reduce potential future liabilities by insuring destruction of the waste. The paint stripping

wastewater produced following implementation of the previously discussed water segregation measures is estimated to have the following contaminant concentrations: 600 ppm toluene diisocyanate, 6000 ppm xylene, 2100 ppm toluene, and 3000 ppm other hydrocarbons. This waste should be amenable to treatment by a number of common industrial waste treatment technologies including activated sludge treatment and activated carbon adsorption. Treatment services are provided by a number of companies in California, including IT Corp. in Martinez.

5.1.3 Recommendations

Lockheed should reroute drainage from the roof of Building 211 to either the paved area around the building or to storm drainage ditches. Additionally, Lockheed should install trigger spray nozzles on the safety water hoses so that safety water will be available at the stripping site without having to provide a constant flow. Lockheed management should check periodically to insure such nozzles are in use. Finally, Lockheed should investigate options for off-site treatment of paint stripper waste in preference to the current practice of solidification followed by land disposal.

5.2 FUEL WASTE

Fuel waste (JP-7 and JPTS) and water is generated through continuous rinsing of certain aircraft while refueling and defueling, and through runway washdown after refueling and defueling. This fuel/water mixture is collected in a holding tank and then shipped off-site in bulk for recycling at Newhall Refinery. The waste material is approximately 98 percent water contaminated with JP-7 and JPTS (tetraethyl bromine stabilized in hydraulic oil). Approximately 379,400 lb (45,000 gal) of this waste was generated in 1984. Transportation and recycling costs were not available for this waste. No opportunities for reducing the volume of this waste stream were identified, due to the extremely unstable nature of tetraethyl bromine.

5.3 HYDRAULIC OIL WASTE

5.3.1 Waste Generation and Management Practices

Hydraulic oil waste is generated during maintenance and repair of aircraft at Lockheed. Hydraulic oil is removed from planes and drained into drums during maintenance operations, and is also used to flush hydraulic lines following repairs. Hydraulic oil contaminated only with particulate matter is recycled

on-site through filtration for reuse in aircraft hydraulic systems. Hydraulic oil contaminated with chlorine (from chlorinated solvents used in maintenance and repair) cannot be reused on-site because chlorine attacks the seals in aircraft hydraulic systems. Chlorine contaminated oil is shipped in drums to Lockheed-Burbank and is then shipped to Asberry Oil for recycling. Approximately 15,200 lb (1800 gal/yr) of oil waste is shipped off-site to Asberry Oil for recycling. The cost of off-site recycling was not available.

5.3.2 Waste Minimization Opportunities

Hydraulic oil waste may be recycled or reused on-site through several means as discussed below.

5.3.2.1 On-Site Recycling

Chlorine contaminated hydraulic oil waste may be recycled on-site for reuse in aircraft hydraulic systems. Recycling systems are available which can remove chlorinated solvent from hydraulic oil through flash vaporization or vacuum distillation. These units combine filtration systems for particulate removal and vaporization or vacuum distillation systems for water and chlorinated solvent removal to achieve hydraulic fluid clean-up. They typically require several cycles to produce a recycled oil of satisfactory quality for most applications. However, these units may not be able to remove chlorinated solvent to a sufficient degree to allow reuse of the recovered hydraulic oil in aircraft hydraulic systems. Therefore, bench testing of the process on Lockheed hydraulic oil would be required to evaluate its ability to meet recycled product quality requirements. Small portable recycling units cost approximately \$9,000 and would also require the purchase of a small tank, for a total cost of approximately \$11,000. If such a system can produce a satisfactory product, it would result in savings of \$6940/yr based on savings in material purchase costs of \$7300/yr and operating costs of \$360/yr (current disposal costs were not available for this waste for inclusion in this analysis). The payback period for the system would be 19 months.

5.3.2.2 On-Site Reuse as Fuel

Alternately, if a recycling system is not able to satisfactorily recycle these materials, hydraulic oil waste may be able to be reused as fuel on-site in the central steam plant at Site 2. Hydraulic oil can be blended with No. 2 fuel oil in the fuel storage tank and burned for energy recovery if the chlorine content is small, (i.e., in the part per million range). There would be no cost for this approach to waste oil reuse as fuel;

however, because oil is used as the secondary fuel to gas at Lockheed, waste may have to be accumulated and stored for a relatively long period of time until burned. Alternately, waste oil could be co-fired in the boiler with gas using the existing oil nozzles; a small holding tank and some piping modifications, costing approximately \$1500 would be necessary. On-site burning of waste as fuel is currently exempted from regulation under California law; however, on January 1, 1986, the regulatory status of this practice will change and requirements that may be placed on it are uncertain. If permitting were to be required under the new rules, on-site burning would not be economically feasible due to the small volume of waste oils generated. For example, if an incineration permit similar to a RCRA incinerator permit were to be required for this activity, the cost for obtaining a permit could be \$200,000. Thus, the cost of obtaining a permit alone would greatly exceed the cost of off-site disposal.

5.3.3 Recommendations

It is recommended that Lockheed evaluate on-site recycling of chlorine-contaminated hydraulic oil. The initial step in evaluating on-site recycling would be to bench test available systems on Lockheed oil to determine if recycled product quality is satisfactory. Bench scale testing may be done by the manufacturer using a sample submitted by Lockheed, or may be able to be done on-site using a system loaned by the vendor for test purposes. If product quality is acceptable for reuse, Lockheed should implement on-site recycling.

If this recycling system is unable to meet quality requirements, it is recommended that Lockheed continue its current disposal practice until new California regulations are issued in 1986 governing waste reuse as fuel. At that time, Lockheed should review these requirements to determine if they effectively prohibit on-site burning of waste oil as fuel through implementation of a restrictive permit system or through other requirements. If not, Lockheed should dispose of waste oil on-site through reuse as fuel.

5.4 SOLVENT WASTE

Solvent waste is generated at Lockheed during aircraft assembly and maintenance through hand cleaning of parts and equipment. Solvent is collected in drums at the point of waste generation and shipped to Lockheed-Burbank, where it is stored in bulk tanks and eventually shipped to Oil and Solvent Process Company (OSCO) in Azusa, CA, for reuse by fuel blending for cement kiln fuel.

Solvent waste consists of a mixture of methyl ethyl ketone (MEK), isopropanol (IPA), and 1,1,1-trichloroethane (TCA). Approximately 8,000 lb (950 gal) of mixed solvent waste is generated annually. Waste solvent disposal costs are estimated to be \$0.74/gal, resulting in a total annual disposal cost of \$700/yr.

Due to the low volume of mixed solvent waste generated and the presence of chlorinated solvents, no opportunities for reducing the volume of this waste stream were identified.

5.5 RAG WASTE

5.5.1 Waste Generation and Management Practices

Rag waste contaminated with solvents and alodine is generated at Lockheed during hand cleaning of parts and equipment. These rags are collected in 3 yd³ dumpsters in the plant area and are shipped for landfill disposal at Casmalia in 25 yd³ containers. Previously, rags were shipped to an industrial dry cleaner for recycling; however, local industrial dry cleaners no longer offer this service (according to Lockheed personnel) due to the complex waste stream resulting from dry cleaning rags contaminated with cyanides, cadmium, solvents, and other materials.

Approximately 3 yd³ of rags are generated weekly at Lockheed or 163 yd³/yr (40,750 lb). Disposal of rag waste at Casmalia costs \$4700/25 yd³, including an \$850 fee for transportation and \$3850 for disposal. The annual cost for rag disposal is therefore \$30,500/yr.

5.5.2 Waste Minimization Opportunities

Rag waste can be minimized through recycling by dry cleaning. As industrial dry cleaning services are not available off-site, a central on-site facility for dry cleaning rags from all AFP 42 contractors may be justified. The establishment of such a centralized dry cleaning plant at AFP 42 is discussed in Section 7.2.

5.5.3 Recommendations

Recommendations regarding minimization of rag waste are discussed in Section 7.3.

6.0 WASTE MINIMIZATION PROGRAM: NERO AND ASSOCIATES

This section provides a description of current waste generation and management practices by waste stream at AFP 42 - Nero and Associates. The following subsections present detailed descriptions of each waste stream and current management methods; waste stream material balances (where appropriate); opportunities for waste minimization; system economics; and recommendations for system implementation. This information is provided in support of the conclusions and recommendations provided in Section 2. Work sheets for each waste stream are included in Appendix E.

6.1 OIL WASTE

6.1.1 Waste Generation and Management Practices

Oil waste is generated by Nero and Associates through vehicle maintenance at AFP 42. Oil waste is principally motor (lube) oils with some hydraulic oils, contaminated with metals and grit. Oil waste is collected in drums, stored, and pumped out and shipped in bulk to Lakewood Oil Co. for reuse through fuel blending. Approximately 12,500 lb (1600 gal) of oil waste is generated annually by Nero. Oil waste is transported and recycled by Lakewood oil at no cost.¹

6.1.2 Waste Minimization Opportunities

Oil waste may be reused on-site as fuel in Nero's gas/oil fired boilers. Oil waste can be mixed with fuel oil, which is used at Nero as the backup fuel to gas, and stored in fuel oil tanks until needed. This approach would entail no additional cost; however, because oil is only used as a backup to gas in case service is interrupted, waste may have to be stored on-site for long periods before reuse. Alternately, the existing oil feed nozzle could be used to co-fire oil waste at a low rate with gas. A small storage tank and minor piping modifications, estimated to cost \$1500, would be required to implement this approach.

Under current California hazardous waste law, burning hazardous waste as fuel is exempt from regulation; additionally, storage prior to burning is also exempt, so no additional permits are needed for this activity. However, on January 1, 1986, burning

1 All costs given for disposal include transportation unless otherwise noted.

TABLE 6-1
AFP 42: NERO AND ASSOCIATES
WASTE GENERATION RATES AND MANAGEMENT PRACTICES

WASTE	SOURCE/CONTENT	1984 GENERATION RATE	CURRENT ¹ MANAGEMENT PRACTICES	CURRENT* COSTS	CHANGES PROJECTED/COMMENTS
1. Oil Waste	Vehicle maintenance	12,500 lb (1600 gal)	Collected in drums Bulk transport Fuel blending at Lakewood Oil	None	None
2. Jet Fuel Waste	Fueling overflow, filter checks, and tank drain- age	4,500 lb (600 gal)	Collected in drums Bulk transport Fuel blending at Lakewood Oil	None	None
3. Solvent Waste	Vehicle maintenance	750 lb (100 gal)	Collected in drums Bulk transport Fuel blending at Lakewood Oil	None	None
4. Empty Drums	Raw material and shipping	4,000 lb (100 drums)	Stored Reconditioned off-site	\$300-600 (revenue)	None
5. Rag Waste	Vehicle maintenance and equipment cleaning	7250 lb (29 yd ³)	Collected in dumpsters Landfilled in sanitary landfill	\$600	None

*Unit costs are provided in Appendix A. All costs include transportation unless otherwise noted.

hazardous waste as fuel will no longer be exempt from regulation and the regulatory requirements that may be placed on this activity are uncertain. If permitting were to be required or other restrictive regulations are imposed, on-site reuse as fuel would not be justifiable due to the relatively small volume of wastes generated. For example, if a permit similar to a RCRA incineration permit were to be required, the estimated cost for permitting alone would be \$200,000. Expenses of this magnitude are not justified given the small volume of wastes involved.

6.1.3 Recommendations

It is recommended that Nero continue off-site recycling of oil waste through reuse as fuel until new California regulations are issued governing waste reuse as fuel in 1986. At that time, Nero should review these requirements to determine if they effectively prohibit on-site burning of oil waste as fuel through implementation of a restrictive permit system or through other requirements. If not, Nero should dispose of oil waste on-site through reuse as fuel.

6.2 JET FUEL WASTE

Jet fuel waste is generated at Nero from collection of fueling overflows, filter checks, and fuel tank drainage. Jet fuel waste is collected in drums, stored, and pumped and shipped in bulk to Lakewood Oil Co. for reuse through fuel blending. Approximately 4,500 lb (600 gal/yr) of fuel waste is generated at Nero. Jet fuel waste is transported and disposed at no cost. Other than possible reuse as fuel on-site, as discussed for oil waste in section 6.1.2, no further opportunities for minimizing this waste were identified. Recommendations made for oil waste in section 6.1.3 also apply to this waste.

6.3 SOLVENT WASTE

Small amounts of aliphatic petroleum solvent waste is generated by Nero through vehicle maintenance (part cleaning) and painting and paint clean-up. This waste is collected in drums, stored and pumped out and shipped in bulk to Lakewood Oil Co. for reuse through fuel blending. An estimated 750 lb (100 gal) of solvent waste are generated annually. Solvent waste is transported and recycled by Lakewood at no cost. Other than possible reuse as fuel on-site, as discussed for oil waste in section 6.1.2, no further opportunities for minimizing this waste were identified. Recommendations made for oil waste in section 6.1.3 also apply to this waste.

6.4 EMPTY DRUMS

Empty drums are generated at Nero through use of drum contents. Drums are stored on-site and shipped to acceptable drum recyclers as identified by the California Department of Health Services (DOHS). Approximately 100 empty drums are generated annually. When empty drums are shipped in 150 drum loads, Nero receives a revenue of \$3 to \$6/drum (or \$450 to \$900/truckload); when shipped in smaller numbers, transportation and disposal are provided by recyclers at no charge. No recommendations are made for minimization of this waste.

6.5 RAG WASTE

6.5.1 Waste Generation and Management Practices

Rag waste is generated at Nero and Associates through part cleaning during vehicle maintenance. Rags are collected in dumpsters and disposed of in a sanitary landfill. Rag waste is typically contaminated with hydraulic and motor oils. Approximately 70 bales (estimated to be approximately 29 yd³) of rags are disposed of annually by Nero. As this waste is disposed of in a sanitary landfill, the disposal cost for this waste is estimated to be small (\$600/yr or less). The purchase cost for rags is \$2200/yr.

6.5.2 Waste Minimization Opportunities

Off-site disposal of rag waste can be minimized through on-site dry cleaning of rag waste in a central industrial dry cleaning plant. The establishment of such a facility is discussed in Section 7.2 of this report.

6.5.3 Recommendation

Recommendations concerning the establishment of an on-site dry cleaning facility at AFP 42 are presented in Section 7.3 of this report.

7.0 ON-SITE RAG CLEANING

7.1 WASTE GENERATION AND MANAGEMENT PRACTICES

Rag waste is generated by all AFP 42 contractors through aircraft part and assembly cleaning, painting operations and plant equipment cleaning. Dirty rags are shipped off-site for disposal in either hazardous waste or sanitary landfills. Approximately 1500 yd³/yr are generated by the four contractors. Rag waste generation rates and disposal costs by contractor are shown in Table 7-1.

Current disposal costs are estimated to be approximately \$100,000/yr for the four AFP 42 contractors. Purchase costs are estimated to be \$150,000/yr (based on a cost of \$40/bale or \$100/yd³). Thus, the total purchase and disposal cost for rags at AFP 42 is \$250,000/yr.

7.2 Waste Minimization Opportunities

Rag waste (except paint rags) generated at AFP 42 can be reused through laundering or dry cleaning. On-site rag cleaning is performed at AFP 6 in Marietta, GA, and other plants, such as AFP 85 in Columbus, OH, use off-site industrial cleaning services for rag supply. Due to the restrictions imposed by the limited capabilities of the wastewater treatment plant at AFP 42, it is probable that a laundry facility for AFP 42 would have to be of the dry cleaning type.

In order to process 1500 yd³/yr, an on-site facility operating 8 hr/day, 5 days/wk, would need to be able to process 180 lb/yr. Therefore, two 100 lb industrial extractors should be sufficient to meet cleaning requirements. Additionally, a small building would be required to house the operation. The estimated capital cost for the installation is \$130,000. The estimated operating costs for the operation are \$205,000/yr including an operating cost of \$0.20/lb processed, salary for two operators, and rag replacement rate of 20% of the total amount of rags processed per year. Therefore, savings over current disposal practices would be \$45,000/yr, resulting in a payback period of three years.

On-site dry cleaning would produce a small amount of waste which would require off-site disposal. Dry cleaning machines have stills for recycling the cleaning solvent used (typically, perchloroethylene). Distillation of the dry cleaning solvent produces still bottoms composed of oils, grease, and entrained solvent. These still bottoms would probably be able to be disposed of through off-site fuel blending. The cost of off-site disposal of still bottoms, estimated to be \$1500/yr (based upon a generation rate of 1 percent of the total volume of rags cleaned), has been included in the \$0.20/lb operating cost used in calculating annual costs for the operations.

TABLE 7-1
AFP 42: WASTE RAG GENERATION
BY CONTRACTOR - AFP 42

CONTRACTOR	1984 RAG GENERATION (POUNDS)	RAG DISPOSAL COST (\$)
Rockwell	325,000 (1300 yd ³)	65,000
Northrop	1,700 (7 yd ³)	1,600
Lockheed	40,750 (163 yd ³)	30,500
Nero	7,250 (29 yd ³)	600
TOTALS	374,700 (1499 yd ³)	97,700

The on-site facility could be operated by one of the current base contractors, which would provide cleaning services to the other contractors on a fee basis; or could be operated by an outside laundry contractor.

7.3 RECOMMENDATIONS

It is recommended that the Air Force and AFP 42 contractors investigate the possibility of establishing an on-site dry cleaning operation to recycle shop rags. Initial analysis indicates that such an operation would have a favorable payback period and would reduce liabilities associated with off-site land disposal of waste rags.

APPENDIX A
UNIT WASTE MANAGEMENT COSTS

1. Casmalia Resources, Casmalia, CA

A. Disposal

1. Solidified flammable organics -	\$187/drum
2. Solidified wastewater with paint -	\$0.23/gal
3. Waste rags (bulk) (Lockheed) -	\$3855/25 yd ³
4. Waste rags (drums) (Northrop) -	\$62/drum
5. Waste rags (bulk) (Rockwell) -	\$50/yd ³
6. Paint booth sludge -	\$62/drum

B. Transport (to Casmalia by Pacific Vacuum Truck)

1. Drums -	\$15.13/drum
2. Bulk liquids -	\$0.13/gal

2. Systech, Torrance, CA

A. Disposal

1. Bulk flammable liquids -	\$0.15/gal
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B. Transport (to Systech by Pacific Vacuum Truck)

1. Bulk liquids -	\$0.14/gal
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WORK SHEETS - ROCKWELL

PLANT # 42
OPERATOR: Roxwell
DATE: _____

WASTE MINIMIZATION PROGRAM
DATA SHEET

WASTE STREAM: Waste Flammable Liquid NOS

CHARACTERISTICS: Hydraulic fluid 50-60%, MEK
25-30%, Lube oil 8-10%

(ATTACH ANALYSIS IF AVAILABLE)

SOURCE/MANAGEMENT: Collected in drums at generating
site - segregated by type. Pumped into tank trucks
together (mixed) for bulk transport. Sent to Oil
and Solvent Process Co. (OSCO) for disposal by
fuel blending.

GENERATION 1. RATE: 10,180 gal/yr
2. FREQUENCY: 2 shipments/yr
3. COST: \$0.30/gal (estimated)

PROPOSED CHANGES: MEK has been replaced by Turco 4460,
IPA, and other lower volatility/toxicity solvents
due to SCA QMA regulations

RAW MATERIAL DATA 1. CHARACTERISTICS: _____
2. QUANTITY: _____
3. COST: Turco 4460 - \$700/gal on average
Hydraulic oil - \$4.50/gal

NOTES: _____

PLANT # 42
OPERATOR: Rockwell
DATE: _____

WASTE MINIMIZATION PROGRAM
DATA SHEET

WASTE STREAM: Waste Flammable Solid NOS

CHARACTERISTICS: MEK 20-80%, Acetone 20-80%
air-solvent 20-80%, hydraulic oil 20-80%

(ATTACH ANALYSIS IF AVAILABLE)

SOURCE/MANAGEMENT: Paint shop wastes collected in drums in shop. Solidified with vermiculite and being collected. Shipped in drums to Cassia Resource for Landfilling.

GENERATION

1. RATE: 127 drums / yr
2. FREQUENCY: 3 shipments / yr
3. COST: \$ 200 / drum

PROPOSED CHANGES: Due to SCAQMD regulations, have switched from MEK to Turco 4460 old VWR Reagent I.

RAW MATERIAL DATA

1.	CHARACTERISTICS:	
2.	QUANTITY:	
3.	COST:	<u>Tarbo 4460 - \$7.00 / gal</u> <u>VWR Blend 1 - \$2.83 / gal</u>

NOTES: _____

PLANT # 42
OPERATOR: Rockwell
DATE: _____

WASTE MINIMIZATION PROGRAM
DATA SHEET

WASTE STREAM: Poly-chlorinated Biphenyl (Ascarel)

CHARACTERISTICS: >500 ppm PCB in oil

(ATTACH ANALYSIS IF AVAILABLE)

SOURCE/MANAGEMENT: Leaking transformer - collected and
shipped in drums to North American
Environmental for incineration

GENERATION 1. RATE: 4300 lbs
 2. FREQUENCY: Generated once
 3. COST: _____

PROPOSED CHANGES: _____

RAW MATERIAL DATA 1. CHARACTERISTICS: _____
 2. QUANTITY: _____
 3. COST: _____

NOTES: _____

PLANT # 42
OPERATOR: Rockwell
DATE: _____

WASTE MINIMIZATION PROGRAM
DATA SHEET

WASTE STREAM: Transformers

CHARACTERISTICS: PCB solid >500

(ATTACH ANALYSIS IF AVAILABLE)

SOURCE/MANAGEMENT: Sent to North American Environmental
Drained
Land disposal of transformer casings
From transformer decommissioning
due to leaks

GENERATION 1. RATE: 18,100 lbs - 2 transformers
 2. FREQUENCY: 2 transformers - once
 3. COST: _____

PROPOSED CHANGES: _____

RAW MATERIAL DATA 1. CHARACTERISTICS: _____
 2. QUANTITY: _____
 3. COST: _____

NOTES: _____

PLANT # 42
OPERATOR: Rockwell
DATE: _____

WASTE MINIMIZATION PROGRAM
DATA SHEET

WASTE STREAM: PCB Contaminated Solids

CHARACTERISTICS: PCB <50 ppm

(ATTACH ANALYSIS IF AVAILABLE)

SOURCE/MANAGEMENT: Rags, clothing, concrete from PCB
leak cleanup

Sent to California in drum (rags and clothing)
and in bulk C concrete in dump truck

GENERATION 1. RATE: 18,810 lbs
 2. FREQUENCY: generated once
 3. COST: _____

PROPOSED CHANGES: _____

RAW MATERIAL DATA 1. CHARACTERISTICS: _____
 2. QUANTITY: _____
 3. COST: _____

NOTES: _____

PLANT # 42
OPERATOR: Rockwell
DATE: _____

WASTE MINIMIZATION PROGRAM
DATA SHEET

WASTE STREAM: Empty drums

CHARACTERISTICS: Contained non-chlorinated
solvents, tube oils, hydraulic fluid

(ATTACH ANALYSIS IF AVAILABLE)

SOURCE/MANAGEMENT: From product use. Crushed and
shipped to Casmalia for land
disposal

GENERATION 1. RATE: 300 drums/yr
 2. FREQUENCY: 4 times/yr
 3. COST: _____

PROPOSED CHANGES: _____

RAW MATERIAL DATA 1. CHARACTERISTICS: _____
 2. QUANTITY: _____
 3. COST: _____

NOTES: _____

PLANT # 42
OPERATOR: Rockwell
DATE: _____

WASTE MINIMIZATION PROGRAM
DATA SHEET

WASTE STREAM: Paint Booth Waste

CHARACTERISTICS: Water - 99 %, with some chromates

(ATTACH ANALYSIS IF AVAILABLE)

SOURCE/MANAGEMENT: Generated from paint booth waterwall;
stripping, and ~~se~~ primer sanding. Collected in
tank in paint shop floor, sent through ion exchange
system to remove chrome, and then discharge
to AFP 42 WWTP

GENERATION 1. RATE: 41,700 gal / yr
 2. FREQUENCY: Weekly
 3. COST: _____

PROPOSED CHANGES: _____

RAW MATERIAL DATA 1. CHARACTERISTICS: _____
 2. QUANTITY: _____
 3. COST: _____

NOTES: _____

PLANT # 42
OPERATOR: Rockwell
DATE: _____

WASTE MINIMIZATION PROGRAM
DATA SHEET

WASTE STREAM: Ion Exchange Resin

CHARACTERISTICS: Cationic resin saturated with
Cr. reme.

(ATTACH ANALYSIS IF AVAILABLE)

SOURCE/MANAGEMENT: From charge out of ion exchange
system resin. Drummed and shipped to Casmaia
for land filling

GENERATION 1. RATE: 825 gal / yr
 2. FREQUENCY: _____
 3. COST: \$200 / drum

PROPOSED CHANGES: _____

RAW MATERIAL DATA 1. CHARACTERISTICS: _____
 2. QUANTITY: _____
 3. COST: _____

NOTES: _____

PLANT # 42
OPERATOR: Rockwell
DATE: _____

WASTE MINIMIZATION PROGRAM
DATA SHEET

WASTE STREAM: Waste Diesel Fuel and Water

CHARACTERISTICS: Water - 90%, diesel - 10%

(ATTACH ANALYSIS IF AVAILABLE)

SOURCE/MANAGEMENT: Tank bottoms from fuel tank
cleanup. Shipped in bulk to California for
treatment

GENERATION 1. RATE: 3000 gal
2. FREQUENCY: generated once.
3. COST: _____

PROPOSED CHANGES: _____

RAW MATERIAL DATA 1. CHARACTERISTICS: _____
2. QUANTITY: _____
3. COST: _____

NOTES: _____

PLANT # 42
OPERATOR: Rockwell
DATE: _____

WASTE MINIMIZATION PROGRAM
DATA SHEET

WASTE STREAM: Waste Regenerate Solution

CHARACTERISTICS: Neutralized HCl and NaOH

(ATTACH ANALYSIS IF AVAILABLE)

SOURCE/MANAGEMENT: From regeneration of water deionizing system (mixed resin). HCl, NaOH used to neutralize each other. If necessary, adjust pH, then discharge to AFP 42 WWTP

GENERATION 1. RATE: 5000 gal/day
2. FREQUENCY: twice/day
3. COST: _____

PROPOSED CHANGES: _____

RAW MATERIAL DATA 1. CHARACTERISTICS: _____
2. QUANTITY: _____
3. COST: _____

NOTES: _____

PLANT # 42
OPERATOR: Rockwell
DATE: _____

WASTE MINIMIZATION PROGRAM
DATA SHEET

WASTE STREAM: Waste Ammonia

CHARACTERISTICS: Solidified alkaline solution

(ATTACH ANALYSIS IF AVAILABLE)

SOURCE/MANAGEMENT: From aircraft surface prep. Cleaning solution, collected in drums and solidified with ad sorbent. Sent to Caswell for land filling

GENERATION 1. RATE: 4000 lbs/yr
 2. FREQUENCY: _____
 3. COST: \$ 200/drum

PROPOSED CHANGES: _____

RAW MATERIAL DATA 1. CHARACTERISTICS: _____
 2. QUANTITY: _____
 3. COST: _____

NOTES: _____

PLANT # 42
OPERATOR: Rockwell
DATE: _____

WASTE MINIMIZATION PROGRAM
DATA SHEET

WASTE STREAM: Waste rags

CHARACTERISTICS: Rags contaminated with
solvent, oil, alodine, etc.

(ATTACH ANALYSIS IF AVAILABLE)

SOURCE/MANAGEMENT: Hand cleaning of parts and assemblies
collected in small containers and dumpsters. Transported
in large rolloffs to Casmalia for disposal.

GENERATION 1. RATE: 1300 yd³/yr
 2. FREQUENCY: _____
 3. COST: \$ 50/yd³

PROPOSED CHANGES: _____

RAW MATERIAL DATA 1. CHARACTERISTICS: _____
 2. QUANTITY: _____
 3. COST: _____

NOTES: _____

WORK SHEETS - NORTHROP

PLANT # 42
OPERATOR: Northrop
DATE: 6/20

WASTE MINIMIZATION PROGRAM
DATA SHEET

WASTE STREAM: Thinning Compound

CHARACTERISTICS: MEK 85%, acetone 5%, Naptha
aliphatic 5%, Miscell. Others

(ATTACH ANALYSIS IF AVAILABLE)

SOURCE/MANAGEMENT: Generated in painting operations. Drummed
in paint shop and shipped to Hawthorne.
Disposed by incineration / reuse as fuel at
Synertek. Note that generally components are
generated and drummed separately, not
mixed. Wastes are consolidated at Hawthorne
for shipment to Synertek. MEK used for
thinning and wipe down

GENERATION 1. RATE: 1425 gal/yr
2. FREQUENCY: year
3. COST: \$0.51/gal / \$1.15 for disposal, rest is transport)

PROPOSED CHANGES: Use of MEK discontinued in 1/85 due to
AQMD's requirements. Have replaced ~~Turco~~ MEK
within painting with primarily Turco
4460 (thinning and surface cleaning) and
Turco Lock (gun cleaning). 1985 generation
(projected) is 932 gal 4460, 160 gal Turcolock (from waste)

RAW MATERIAL DATA 1. CHARACTERISTICS: _____
2. QUANTITY: _____
3. COST: _____

NOTES: Turcolock is 50% TCA, 50% Methylene Chloride
4460 is 50% aromatic petroleum, 20% Ethyl
acetate, 20% MIBK, and 10% Isopropanol

PLANT # 42
OPERATOR: Northrop
DATE: _____

WASTE MINIMIZATION PROGRAM
DATA SHEET

WASTE STREAM: Waste Flammable Solvents

CHARACTERISTICS: Naptha, Stoddard, IPA, ellosolve
acetate

(ATTACH ANALYSIS IF AVAILABLE)

SOURCE/MANAGEMENT: Used in hand cleaning of parts and
assemblies. Also in hydraulic line cleaning (Naptha).
Drum transport to Hawthorne where it is consolidated
(bunded) and shipped to Systech for fuel blending

GENERATION 1. RATE: 440 gal/yr
 2. FREQUENCY: _____
 3. COST: \$ 0.51/gal

PROPOSED CHANGES: _____

RAW MATERIAL DATA 1. CHARACTERISTICS: _____
 2. QUANTITY: _____
 3. COST: _____

NOTES: _____

PLANT # 42
OPERATOR: Northrop
DATE: _____

WASTE MINIMIZATION PROGRAM
DATA SHEET

WASTE STREAM: Waste Jet Fuel (JP-4)

CHARACTERISTICS: Aviation fuel with minor contamination

(ATTACH ANALYSIS IF AVAILABLE)

SOURCE/MANAGEMENT: From maintenance of fuel tanks.
Collected and shipped to Hawthorne in drums.
Consolidated and shipped to Systech for fuel blending.

GENERATION 1. RATE: 1700 gal/yr
 2. FREQUENCY: _____
 3. COST: \$ 0.51/gal

PROPOSED CHANGES: _____

RAW MATERIAL DATA 1. CHARACTERISTICS: _____
 2. QUANTITY: _____
 3. COST: _____

NOTES: _____

PLANT # 42
OPERATOR: Northrop
DATE: _____

WASTE MINIMIZATION PROGRAM
DATA SHEET

WASTE STREAM: Waste Paints

CHARACTERISTICS: Lacquer, enamel, polyurethane
paints with thinner

(ATTACH ANALYSIS IF AVAILABLE)

SOURCE/MANAGEMENT: From paint booth cleanup. Shipped in
drums to Hawthorne - Consolidated and shipped to Systech
for fuel blending.

GENERATION 1. RATE: 1350 gal/yr
2. FREQUENCY: _____
3. COST: _____

PROPOSED CHANGES: Switched to Turco 4460 Thinner
from MEK.

RAW MATERIAL DATA 1. CHARACTERISTICS: _____
2. QUANTITY: _____
3. COST: _____

NOTES: _____

PLANT # 42
OPERATOR: Northrop
DATE: _____

**WASTE MINIMIZATION PROGRAM
DATA SHEET**

WASTE STREAM: Paint Booth Wastes

CHARACTERISTICS: Water with paint sludge

(ATTACH ANALYSIS IF AVAILABLE)

SOURCE/MANAGEMENT: From cleantool of waterwall sump.
Collected in drums, shipped to Hawthorne, then to
Cosmolia for landfill

GENERATION 1. RATE: 450 gal/yr
 2. FREQUENCY: _____
 3. COST: \$1.11/gal

PROPOSED CHANGES: _____

RAW MATERIAL DATA 1. CHARACTERISTICS: _____
 2. QUANTITY: _____
 3. COST: _____

NOTES: _____

PLANT # 42
OPERATOR: Northrop
DATE: _____

WASTE MINIMIZATION PROGRAM
DATA SHEET

WASTE STREAM: Hydraulic Oils

CHARACTERISTICS: Hydraulic oil with contamination

(ATTACH ANALYSIS IF AVAILABLE)

SOURCE/MANAGEMENT: From hydraulic line maintenance.
Collected in drums and shipped to Hawthorne.
Consolidated and shipped in bulk to Systech for
fuel blending.

GENERATION 1. RATE: 825 gal/yr
 2. FREQUENCY: _____
 3. COST: \$ 0.51 / gal

PROPOSED CHANGES: _____

RAW MATERIAL DATA 1. CHARACTERISTICS: _____
 2. QUANTITY: _____
 3. COST: \$ 4.50 / gal

NOTES: Bk. yco Oil 8805

PLANT # 42
OPERATOR: Northrop
DATE: _____

WASTE MINIMIZATION PROGRAM
DATA SHEET

WASTE STREAM: Fuel oil and water

CHARACTERISTICS: Diesel fuel and water

(ATTACH ANALYSIS IF AVAILABLE)

SOURCE/MANAGEMENT: From tank cleaning. Waste oil
sent to Systech for fuel blending. High water
content waste (9000 gal) shipped to BKK for land
disposal.

GENERATION 1. RATE: 1010 gal
 2. FREQUENCY: generated once
 3. COST: _____

PROPOSED CHANGES: _____

RAW MATERIAL DATA 1. CHARACTERISTICS: _____
 2. QUANTITY: _____
 3. COST: _____

NOTES: _____

PLANT # 42
OPERATOR: Northrup
DATE: _____

WASTE MINIMIZATION PROGRAM
DATA SHEET

WASTE STREAM: Waste Rags

CHARACTERISTICS: Rags contaminated with oil
and solvent

(ATTACH ANALYSIS IF AVAILABLE)

SOURCE/MANAGEMENT: Hand cleaning parts and equipment;
painting. Collected in drums and shipped to
Cosmos for land disposal

GENERATION 1. RATE: 7 yd³/yr (26 drums)
 2. FREQUENCY: _____
 3. COST: \$ 62/drum

PROPOSED CHANGES: _____

RAW MATERIAL DATA 1. CHARACTERISTICS: _____
 2. QUANTITY: _____
 3. COST: _____

NOTES: _____

WORKSHEETS - LOCKHEED

PLANT # 42
OPERATOR: Lockheed
DATE: 8/21

WASTE MINIMIZATION PROGRAM
DATA SHEET

WASTE STREAM: Paint, Stripper, and Rinsewater

CHARACTERISTICS: Water contaminated with
Xylene, Toluene, Toluene Diisocyanate, and
metals

(ATTACH ANALYSIS IF AVAILABLE)

SOURCE/MANAGEMENT: Stripper of planes and parts in
paint hanger. Rinsewater collected in in-ground tank
and bulk transported to Casmaia for solidification
(fly ash) and landfilling. Tank also collects roof
runoff through drains and "safety water"

GENERATION

1. RATE: 140,000 gal/yr
2. FREQUENCY: weekly
3. COST: \$0.46/gal

PROPOSED CHANGES: Will replace existing 3000 gal tank
with 10,000 gal tank. Will increase stripping from
1 plane/month to 5 planes/month.

RAW MATERIAL DATA

1. CHARACTERISTICS: _____
2. QUANTITY: _____
3. COST: _____

NOTES: _____

AD-A191 837 WASTE MINIMIZATION PROGRAM AIR FORCE PLANT 42(U) REL
INC BOYNTON BEACH FL 81 FEB 86 ASD/PMDA-42-MNN-001
F89603-84-G-1462-SC01

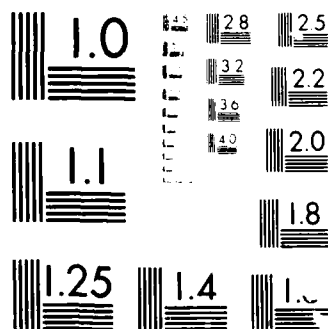
2/2

UNCLASSIFIED

F/G 24/3

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MICROCOPY RESOLUTION TEST CHART
 NATIONAL BUREAU OF STANDARDS-1963-A

PLANT # 42
OPERATOR: Lockheed
DATE: 8/21

WASTE MINIMIZATION PROGRAM
DATA SHEET

WASTE STREAM: Waste Fuel and Water

CHARACTERISTICS: JP-7 and JPTS with water
and JPTS - Thermally stable TEB in Hydraulic oil
TEB - tetra ethyl bromine used to start engine
(ATTACH ANALYSIS IF AVAILABLE)

SOURCE/MANAGEMENT: Generated mostly from on-ground
refueling. Consists of washdown from spilling on
runway, collected in holding tanks. Sent to
Newhall Refinery for recovery.
Certain planes leak fuel when fueled on ground and
are vented continuously

GENERATION 1. RATE: 45,000 gal / 379,500 lbs
2. FREQUENCY: yearly
3. COST: _____

PROPOSED CHANGES: _____

RAW MATERIAL DATA 1. CHARACTERISTICS: _____
2. QUANTITY: _____
3. COST: _____

NOTES: _____

PLANT # 42
OPERATOR: Lockheed
DATE: _____

WASTE MINIMIZATION PROGRAM
DATA SHEET

WASTE STREAM: Hydraulic Oil

CHARACTERISTICS: Hydraulic oil contaminated with
chlorinated solvents

(ATTACH ANALYSIS IF AVAILABLE)

SOURCE/MANAGEMENT: From cleaning hydraulic lines after
repairs/maintenance. Containing chlorinated solvents
in small amounts from cleaning - chlorine attacks
seals in lines. Sent in drums to Asberry Oil
for recycling. Some oils are reused on-site to
stabilize TEB for open burning disposal.

GENERATION 1. RATE: 1800 gal/yr
 2. FREQUENCY: _____
 3. COST: _____

PROPOSED CHANGES: _____

RAW MATERIAL DATA 1. CHARACTERISTICS: _____
 2. QUANTITY: _____
 3. COST: _____

NOTES: Recycle non-chlorine contaminated hydraulic
oil through filtration to remove particulates

PLANT # 42
OPERATOR: Lockheed
DATE: _____

WASTE MINIMIZATION PROGRAM
DATA SHEET

WASTE STREAM: Waste Solvents

CHARACTERISTICS: Trichloroethane, MEK, IPA

(ATTACH ANALYSIS IF AVAILABLE)

SOURCE/MANAGEMENT: Cleaning and maintenance. Hand
cleaning collected together in drums. Shipped in
drums to OSCO for reuse as fuel.

GENERATION 1. RATE: 950 gal / hr
 2. FREQUENCY: _____
 3. COST: \$0.74 / gal

PROPOSED CHANGES: _____

RAW MATERIAL DATA 1. CHARACTERISTICS: _____
 2. QUANTITY: _____
 3. COST: _____

NOTES: _____

PLANT # 42
OPERATOR: Lockheed
DATE: 8/21

WASTE MINIMIZATION PROGRAM
DATA SHEET

WASTE STREAM: Waste Rags

CHARACTERISTICS: Solvent and Allodine 1200, 1000,
600 (most 1200), trichloroethane

(ATTACH ANALYSIS IF AVAILABLE)

SOURCE/MANAGEMENT: Used to send to industrial dry cleaner
for ~~the~~ cleaning/reuse; dry cleaner stopped service
because got rags that had cyanides, radium, etc.
Discontinued due to complex waste stream. Most industrial
dry cleaners seem to have gotten out of this business
due to complex contaminants problem. Hand touch up
of allodine products, wipe cleaning parts, etc. collected
here. Do not segregate by type - have not been able to
segregate effectively. Sent to Casmalin for landfill.

GENERATION 1. RATE: Approx. 3 yd³ container
 2. FREQUENCY: weekly
 3. COST: _____

PROPOSED CHANGES: _____

RAW MATERIAL DATA 1. CHARACTERISTICS: _____
 2. QUANTITY: _____
 3. COST: _____

NOTES: _____

WORKSHEETS - NERO AND ASSOCIATES

PLANT # 42
OPERATOR: Nero
DATE: _____

WASTE MINIMIZATION PROGRAM
DATA SHEET

WASTE STREAM: Waste Oil

CHARACTERISTICS: Lube Oils, some hydraulic

(ATTACH ANALYSIS IF AVAILABLE)

SOURCE/MANAGEMENT: Vehicle maintenance
collected in drums, bulk transport
to Lakewood Oil for reuse as fuel

GENERATION 1. RATE: 1600 gal/yr
 2. FREQUENCY: _____
 3. COST: \$ 0.00

PROPOSED CHANGES: _____

RAW MATERIAL DATA 1. CHARACTERISTICS: _____
 2. QUANTITY: _____
 3. COST: _____

NOTES: _____

PLANT # 42
OPERATOR: Nero
DATE: _____

WASTE MINIMIZATION PROGRAM
DATA SHEET

WASTE STREAM: Waste Jet Fuel

CHARACTERISTICS: JP-4 with contaminants

(ATTACH ANALYSIS IF AVAILABLE)

SOURCE/MANAGEMENT: Fueling overflows filter checks tank
drain lines. Collected in drums,
bulk transport to railcar for
use as fuel

GENERATION
1. RATE: 600 gal/hr
2. FREQUENCY: _____
3. COST: \$10.00

PROPOSED CHANGES: _____

RAW MATERIAL DATA
1. CHARACTERISTICS: _____
2. QUANTITY: _____
3. COST: _____

NOTES: _____

PLANT # 42
OPERATOR: Nero
DATE: _____

WASTE MINIMIZATION PROGRAM
DATA SHEET

WASTE STREAM: Waste Solvents

CHARACTERISTICS: _____

(ATTACH ANALYSIS IF AVAILABLE)

SOURCE/MANAGEMENT: From vehicle maintenance. Collected
in drums and shipped in bulk
to Lakewood Oil. Reuse as fuel.

GENERATION 1. RATE: 100 gal/yr
 2. FREQUENCY: _____
 3. COST: \$0.00

PROPOSED CHANGES: _____

RAW MATERIAL DATA 1. CHARACTERISTICS: _____
 2. QUANTITY: _____
 3. COST: _____

NOTES: _____

PLANT # 42
OPERATOR: Nero
DATE: _____

WASTE MINIMIZATION PROGRAM
DATA SHEET

WASTE STREAM: Empty drums

CHARACTERISTICS: _____

(ATTACH ANALYSIS IF AVAILABLE)

SOURCE/MANAGEMENT: From raw material use. Shipped to
reclaimer for reconditioning. DCHS
identifies reclaimers.

GENERATION 1. RATE: 100 drums/yr
 2. FREQUENCY: _____
 3. COST: \$3-6 / drum revenue if 1 load

PROPOSED CHANGES: _____

RAW MATERIAL DATA 1. CHARACTERISTICS: _____
 2. QUANTITY: _____
 3. COST: _____

NOTES: _____

PLANT # 42
OPERATOR: Nero
DATE: _____

WASTE MINIMIZATION PROGRAM
DATA SHEET

WASTE STREAM: Rags

CHARACTERISTICS: Oil and solvent contaminants

(ATTACH ANALYSIS IF AVAILABLE)

SOURCE/MANAGEMENT: From maintenance and paint cleanup
collected in dumpsters sent to
sanitary landfill.

GENERATION

1. RATE: 29 yd³/yr
2. FREQUENCY: _____
3. COST: _____

PROPOSED CHANGES: _____

RAW MATERIAL DATA

1. CHARACTERISTICS: _____
2. QUANTITY: _____
3. COST: _____

NOTES: _____

WORK SHEETS - ON-SITE DRY CLEANING

TITLE: ON-SITE RAG
CLEANING

PROJECT NO.: AFP-42
PROJECT NAME:

PAGE 1
OF 2

Operating Requirements

$$\text{Rag use} = 1500 \text{ yd}^3/\text{yr}$$

$$1 \text{ yd}^3 = 250 \text{ lbs}$$

$$2500 \text{ rags}/\text{yd}^3$$

$$\text{Rag use} = \frac{1500 \text{ yd}^3}{\text{yr}} \times \frac{250 \text{ lb}}{\text{yd}^3} = 375,000 \text{ lbs}$$

$$\text{Cleaning Capacity} = \frac{375,000 \text{ lb}}{\text{yr}} \times \frac{\text{yr}}{260 \text{ day}} \times \frac{\text{day}}{8 \text{ hr}} = 180 \text{ lb/hr}$$

Equipment Need = 2 - 100 lb/hr industrial extractors

Capital Requirements

2 - 100 lb industrial extractors 70,000
installed @ \$35,000 ea

1 - site fabricated, 500 ft² bldg. 20,000
at \$39/ft² (includes plumbing
and electricity)

Sub 90,000

Contractors OH @ 10% 9,000

Sub 99,000

Engineering @ 10% 9,900

Sub 108,900

Contingencies @ 20% 21,780

Total 130,680

BY: EH
DATE:

CHECKED BY:
DATE:

The Earth Technology
Corporation

TITLE: On-Site Rag Cleaning

PROJECT NO.: AFI² - 42
PROJECT NAME:PAGE 2
OF 2Operating Costs

Commercial cost is \$5.75 / 8 lbs. Assume this includes
OH, capital amortization, labor and actual process
cost = $.33 \times 5.75 = \$1.90 / 8 \text{ lbs} = \$0.24 / \text{lb}$

Assume some economics of scale (15%), then
cost/lb = \$0.20/lb.

$$\text{Operating cost} = \frac{\$0.20}{\text{lb}} \left| \frac{1500 \text{ yd}^3}{\text{yd}^3} \right| \frac{250 \text{ lb}}{\text{yd}^3} = \$75,000$$

2 Operators @ 32,500 each (includes = 65,000
OH and fringe)

Rag replacement @ 20%/yr @ \$100/yd³ = 30,000

 170,000

Contingencies - 20%

 34,000

 204,000
BY: EIT
DATE:CHECKED BY:
DATE:
 The Earth Technology
Corporation

END

DATE

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