is no question that recovery can be effectively increased in every major industry we now serve. If Monsanto does not assume or initiate this program for our own fluids it will be done by another company.

In the case of synthetic fluids, perhaps more so than other chemicals, the customer can, through improved or modified housekeeping procedures, recover synthetic fluids and most do not have to install a waste treatment facility. Each of our key industries is discussed separately with regard to feasibility of synthetic fluids recovery.

Diecasting

Waste treatment facilities are rare in this industry. The only area where treatment is found is for cutting oils and plating chemicals, where the plant machines and paints or plates the diecast part. This market represents about 30% of the 1000 diecasting accounts in the United States, according to Detrex Incorporated, the major supplier of degreasing chemicals and systems.

The major products consumed by the diecaster are dielubes (water or solvent base), lubricating oil and greases, cleaning solvent and hydraulic fluids. Hydraulic fluid (Pydraul) usage is substantial at 20-50% of total fluids consumed in the plant, with larger die-cast plants, i.e., Johnson Motors using the smaller ratio of FR fluid to total chemicals. Although the amount of other products consumed is substantial there appears to be limited intermixing with the waste Pydraul. Dielubes are vaporized when contacted with the hot diecast part and lubricating oils and greases are used in machining

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outside or adjacent to the immediate diecasting area.

Pydraul usage escapes into four separate sources in the diecast plant. These sources include bulk waste (major line breaks and spills) adhered to diecast parts, water effluent and through floor dry absorbent material. A diecaster's "water effluent" is an open trench network in the plant floor that carries cooling water to the diecast machine dies. This water is normally recirculated to a cooling tower with limited overflow to sewer.

Table I displays results found by personal contacts at 9 different diecasting accounts. In all cases either the floor absorbent or the water effluent represented 80-100% of the Pydraul consumed at the account. Those plants reporting no Pydraul escaping into the water effluent have closed cooling water circulating lines. The other accounts reporting escape to water have open accesses where liquids flow freely from the diecasting area directly into the water. In the case of Johnson Motors the machines are cleaned regularly with solvent and everything is flushed into the troughs. At Johnson Motors a total of 85-90% of their Pydraul consumption escapes directly into the water stream.

Based on the above results and our knowledge of the diecasting market, several points are important:

1) Of the estimated 400-500 diecasting shops using synthetic fire resistant fluids only a small percentage have open access trenches where Pydraul contacts water directly.

Although a small percentage, however, these accounts are the larger diecasters (Johnson Motors, Central Foundry, Lester Castings, etc.).

2) The diecaster is concerned about pollution and all are anxious to maximize cost savings. We must expect that the larger volume of fluid escaping into the stream will require the customer to provide adequate sumps/ponds or virtually close off access to his water stream. The logical choice for most is closing off access to insure complete safety from tighter pollution laws. Thus, the majority of the diecasting industry would revert to absorbent as the primary escape source for hydraulic fluids.

Separate fluid analyses from the interceptor pits of "sumps" of Johnson Motors, Lester Castings and Central Diecasting are reported in Table II. In all cases the Pydraul was found to be of high purity. In all cases the Pydraul isn't being reclaimed. The presence of large amounts of solids in the Johnson Motors and Lester Castings samples as well as the 30% non-Pydraul content in the sump of Johnson Motors is felt to be a direct result of housekeeping. Both the level of solids and the amount of contamination from oil, etc., can be controlled. Milt Tegethoff of Findett has indicated that of all the bulk waste and "sump" Pydraul forwarded to him by our customers over the past several years for reclamation all have been of reclaimable quality. In the few cases where analysis beforehand indicated unacceptable fluid quality discussions with plant personnel resulted in fluid of reclaimable quality. It is

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important to note that in cases where the level of solids is high a solvent extraction technique is required for effective Pydraul recovery. Solvent extraction techniques were successfully evaluated by Research on Pydraul-absorbent mixtures. This subject is discussed separately.

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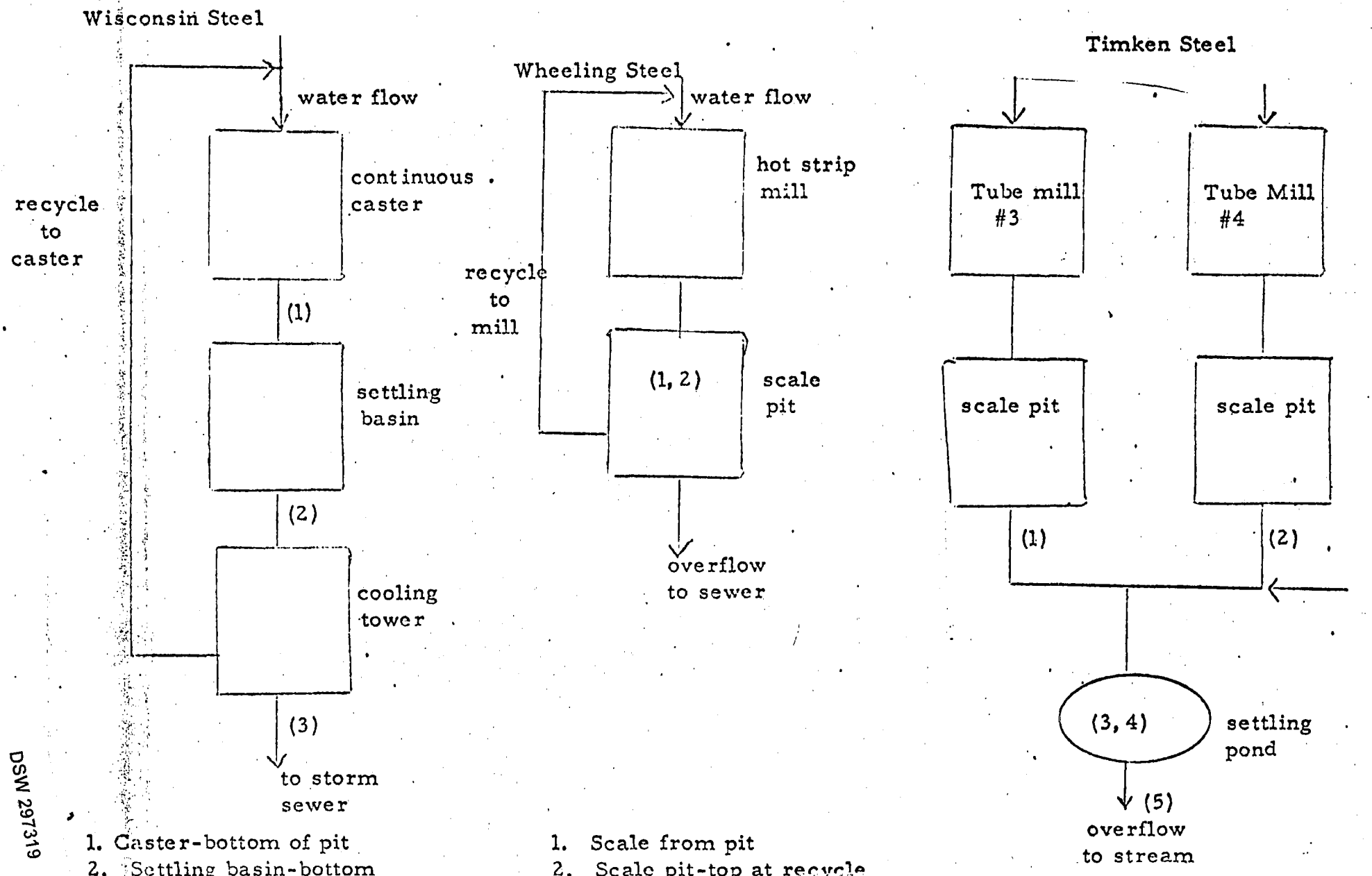
FIGURE I

SCHEMATIC OF WATER FLOW-STEEL ACCOUNTS
SAMPLE ANALYSIS



1. Caster-bottom of pit
2. Settling basin-bottom
3. Cooling tower-top at recycle and overflow point

1. Scale from pit
2. Scale pit-top at recycle and overflow point

1. & 2. Flow from scale pit to pond
2. Pond-top floating oil
4. Pond-bottom sludge
5. Pond-overflow to stream

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Steel Industry

Figure I outlines the operations at Wisconsin Steel, Wheeling-Pittsburgh Steel and Timken Steel where Pydraul is currently being used and where samples were taken of the water and scale pit areas to analyze for Pydraul content and recoverability. The results of these analyses are valuable because each process is different yet typical of high volume Pydraul consumption that comes in direct contact with water. The processes analyzed were a continuous caster, hot strip mill and two tube mills.

In these hot steel operations hydraulic fluid leakages directly contact the cooling water. Oxidized steel solids (scale) settle from the cooling water in the scale or settling pits where residence times were as much as 1-8 hours. Cooling water flow rates through vary from 300-10000 gpm, depending upon operation and size of plant.

Results of the Pydraul analyses from Wisconsin, Wheeling and Timken Steel are reported on Table III. The high Pydraul content in the casting pit and scale pits equals almost the entire reported Pydraul usage at that plant even when using a conservative estimate for the amount of scale produced per day.

The overflow from the pits contains minute quantities of Pydraul. The small amount of fluid and the presence of other chemicals precludes economical recovery using conventional absorptive filtration techniques. Pydraul in the overflow from the settling areas of

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these steel companies ranged from less than one gallon per year to about 200 gallons per year at parts per million levels of 1 or less. Although Pydraul levels are too low for recovery, escape is directly to the sewer which opens questions to pollution control. In the case of every steel company contacted during this study (total 6) waste treatment plants were either in existance or planned for the immediate future. All plants follow essentially the same basic approach to treatment which involves:

1) Deemulsification and flotation of oils.
2) Skimming and concentration of oils both at the scale pit and clarifier areas. Oils are then pumped to storage and either disposed of or reclaimed.
3) Chemical flocculation and clarification of solids and precipitable salts and acids.
4) Filtration of precipitated sludges.
5) Disposal of filtered sludges either by incineration, lagooning or land fill.

The minute quantities of Pydraul overflowing from the scale pits can thus be expected to end up in the sludge. The growing trend for sludge disposal is incineration due to restrictions now being placed on land fills and private lagoons.

For those operations using FR fluids in direct contact with the cooling water, the descaling area has been identified as the prime escape source. Economic recovery of the FR fluids from scale would require solvent extraction. This process, although favorable for

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diecasting appears impractical for the steel industry as:

1) Outside contaminates are high and uncontrollable. In the case of Wheeling Steel the ratio of Pydraul to the other products consumed in their 80 inch hot strip mill is about 1:2 Pydraul:kerosene solvent and 1:500 Pydraul: soluble rolling oil.

2) The growing practice in the steel industry is to sinter dredged scale from the scale pits. The by-product is reused in the steel making process. Sintering temperatures are over 1000°F. indicating adhered Pydraul is vaporized at the sintering plant.

A substantial amount of synthetic fluids are consumed in the steel industry in equipment not in direct contact with water. For example, scrap chargers, increased use of hydraulically operated furnaces, GPE soaking pits fuel-air regulators, etc. Findett customers for reclaimed Pydraul have included Laclede Steel and Wisconsin Steel. It is reasonable and conservative to assume that at least 10-20% of the consumption from the primary steel producers is reclaimable. Fluid in these cases will come from leakage, spillage and mass line breaks.

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TABLE I

PYDRAUL USAGE ESTIMATES-SELECTED DIECASTING PLANTS

	Gallons/Year		Source - % Total Usage				
	Pydraul Usage	Nr. Machines	Water Effluent	Floor Absorbent	Bulk	Diecast Flash	Other
Johnson Motors Waukegan	90,000	100	23-60%[1]	66-25%[2]	<5%	5-10%	--
Lester Castings Bedford, Ohio	12,000	20	25-50[1,3]	60-40%	<5	5	--
Central Diecasting Chicago	3,000	18	----->95[1]-------		<5	--	--
Milwaukee Diecasting Milwaukee	3,000	22	0	>90	<5	5	--
Carter Carburetor St. Louis, Missouri	18,000	48	0	70-80	25-20	5	--
Peat Mfg. Company[4] Norwalk, California	7,000	18	0	100	--	--	--
International Cast. Products, Gardena, Calif.[4]	3,000	9	20	80	--	--	--
ITT General Controls[4] Clendale, California	10,000	17	0	100	--	--	--
Withrow Diecasting[4] Hollywood, California	3,300	16	25	75	--	--	--

1. From actual water effluent sample analyses.
2. Absorbent solvent washed down water drains, thus effluent estimated @ 85-90% total usage.
3. Storm sewer sample. Total includes their estimate of 500-1000 gallons per year recovered from sump.
4. J. H. Davidson survey 5/70.

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TABLE II

SALVAGE FLUID QUALITY-DIECASTING

Company	Johnson Motors		Lester Castings	Central Diecasting
Fluid Used	Pydraul A-200		Pydraul 312	Pydraul 312
Location-Sample	Sump	Stream Bed	Sump	Sump
Analysis-Sample				
% Solids	70	80	44	2
% Fluid	30	20	56	98
Specific Gravity Fluid	1.22	1.41	1.09	1.13
Specific Gravity New Pydraul	1.42	1.42	1.10-1.20	1.10-1.20
% Pydraul	70%	100%	95-100%	100%
Solids Present	Absorbent Aluminum Fines	Absorbent & Inorganic	Absorbent Aluminum Fines	Absorbent Aluminum Fines
Comments on Pydraul Recovery	Solvent extraction required	Solvent extraction required	Solvent extraction required	Filtration type only

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TABLE III

PYDRAUL EFFLUENT ANALYSES
STEEL INDUSTRY
(see Figure I)

	Solid/Fluid[a] Ratio	Pydraul ppm[b]	Pydraul gal/yr	%Total Usage	Recoverability
Wisconsin Steel					
(1) Caster Pit	--	3727	2400[c]	~100%	Difficult-solvent extract
(2) Settling Basin	--	1.53	0.2	nil	N/A
(3) Cooling Tower Overflow	--	0.63	0.1	nil	N/A
Wheeling Steel					
(1) Scale	--	155	2200[d]	≥ 90	Difficult-solvent extract
(2) Scale Pit overflow	--	0.1	200	10-12	N/A
Timken Steel					
(1) #3 Tube Mill	--	0.017	25	0.1	N/A
(2) #4 Tube Mill	--	0.125	200	1	N/A
(3) Pond-Top	1:50	--	--	nil	No evidence of Pydraul-all oil
(4) Pond-bottom	4:1	--	--	--	No evidence of Pydraul, all oil. Solvent extraction from solids require
(5) Pond-overflow	--	0.126	--	--	--

a)excluding water
b)expressed as PCB content
c)at 100 lbs per day scale (solids) throughput
c)at 1 ton per day scale (solids) throughput

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