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SYSTEMANALYSE AV SLAMHANDTERING

DELRAPPORT 2

Oslo, 1. april 1980

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NIVAs hustrykkeri

NIVA - RAPPORT

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SYSTEMANALYSE AV SLAMHANDTERING

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Ekstrakt:

Rapporten er delt i to: DEL A gjev eit grovt oversyn over slamproblemet i Noreg. Ved århundreskiftet vil det bli produsert omlag 130 000 tonn TS/år som kommunalt slam, av dette omlag 75 % frå reinseanlegg med kjemisk felling. 2/3 av slammet kjem frå anlegg med meir enn 5000 pe tilknytta. Eit forsøk på systematisering av slamhandtering og prosesskombinasjonar er gjort. DEL B skildrar 1. utgåva av modellprogrammet PREDES, som reknar massebalansar i reinseanlegg ut frå brukarspesifiserte føresetnader.

4 emneord, norske:	4 emneord, engelske:
1. systemanalyse	1. system analysis
2. slambehandling	2. sludge handling
3. avløpsvatnbehandling	3. wastewater treatment
4. matematisk modell	4. mathematical model

Prosjektleders sign.: Kjell Øren

Seksjonsleders sign.:

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FØREORD

På oppdrag frå NTNF's utval for fast avfall har NIVA arbeidd med prosjektet "Systemanalyse av slamhandtering". NIVA har samstundes ytt forskningsmidlar til prosjektet "Systemanalyse av reinseprosesser". Føreliggjande rapport omfattar begge desse prosjekta.

Av praktiske grunnar er rapporten delt i to. Del A gjer bakgrunnsinformasjon og oversyn over problema frå norsk synsstad, medan del B skildrar sjølve modellpakken som er utvikla. Av omsyn til seinare bruk og spreiing av modellen, er det vurdert føremålstenleg å skriva del B på engelsk.

Sivilingeniør Thor Adriansen har hatt ansvaret for det datatekniske opplegget, og har saman med underskrivne utforma denne rapporten. Professor Peter Balmér ytte stor hjelp i ein tidleg fase av prosjektet, og har også vore med på utarbeiding av ein del av prosessmodellane. Balmér har også gjennomgått og kommentert denne rapporten. Tusen takk for all inspirasjon, Peter!

Oslo, 1. april 1980

Kjell Øren

Kjell Øren

INNHALD

1. INNLEIING

1.1 Bakgrunn og status

Innan PRA-prosjekta var det tidlegare utvikla enkle modellar både for reinseanlegg og slambehandling. Prosjektet "Systemanalyse av slamhandtering" tok utgangspunkt i desse modellane. Sjølv om ein vurderte dei aktuelle kombinasjonane av slamhandtering til å vera relativt avgrensa, fann ein det tenleg å utvikla modellane. I eit tidlegare prosjektnotat frå NIVA er dette vurdert såleis:

" - Det vil gi muligheter for meget lett å beregne slamproduksjon og materialstrømmer for aktuelle anlegg. Dette burde kunne spare mye beregningsarbeide for rådgivende ingeniører.

- Skal en kunne analysere samspillet mellom ulike slambehandlingsenheter, vil modeller trolig være et nødvendig verktøy. Det bør imidlertid bemerkes at kunnskapene om en del slambehandlingsoperasjoner og slamkvaliteter i dag ikke er tilstrekkelig for en slik analyse."

Med utgangspunkt i dei enkle modellane som tidlegare var utvikla ved NIVA, vart difor følgjande arbeidsopplegg føreslege:

ARBEIDSOPPLEGG

"1. Kritisk gjenomgåelse av eksisterende modell for slamproduksjon. Nødvendige forbedringer gjøres, og modeller testkjøres mot reelle data.

2. Forbedringer av eksisterende modell for slambehandling.

a) Det sett av ligninger som er innlagt i modellen, gjennomgås kritisk, og de nødvendige forandringer gjennomføres. Modellen testes og forandres inntil resultatene skjønnsmessig bedømmes som fornuftige.

b) Flere sekvenser av slambehandlingsoperasjoner enn de syv som nå finnes i modellen, innføres. De nødvendige testkjøringer gjennomføres.

c) Ved slambehandling (f.eks. stabilisering) kan slammet undergå kvalitetsforandringer (f.eks. avvannbarhet) som er av liten betydning ved den endelige disponering, men som kan være svært vesentlige ved valg av slambehandling og for dimensjonering av de enkelte slambehandlingsoperasjoner. Det bør vurderes i hvilken utstrekning det er mulig å innføre funksjoner i modellen som gjør det mulig å ta hensyn til slike forhold.

3. Modellen utvikles slik at det er mulig å få med andre parametre enn tørrstoff.

4. Ytterligere videreutvikling av modellen f.eks. at

a) rekkefølgen av slambehandlingsoperasjoner generaliseres slik at en ikke er bundet til gitte sekvenser.

b) modellene for de enkelte slambehandlingsoperasjoner detaljeres slik at det blir mulig å analysere samspillet mellom ulike slam- og vannbehandlingsoperasjoner og å optimalisere dette system. Det er mulig at en videreutvikling av denne type vil gjøre det nødvendig å gå over til en dynamisk modell."

Status for dei einskilde punkter er:

1. Utført. Resultat og føresetnader er gitt i delrapport 1 (1).

2a) Likningane er gjennomgått. Ut frå dette er det vurdert nødvendig å prøva detaljera prosessmodellane i større grad, og bygga opp ein ny modell. Punkt 2a) er difor ikkje fullt ut gjennomført.

b) Utført. Det er nytta ei fleksibel modelloppbygging.

c) Arbeidet er komplisert, og det har ikkje vore mogeleg å få inn dei funksjonane det er nemnt.

3. Utført.

4a) Utført - bruk av fleksibel oppbygging.

b) Ingen optimalisering er utført.

1.2 Avgrensingar

Modellsystemet som er presentert i denne rapporten, har ein del avgrensingar, som fell i to hovudgrupper:

a) Prosesstekniske
dvs. i utvalet av prosessar og sjølve prosessmodellane. Det har vore gjort ein heil del praktiske forsøk med ulike prosessar. Totalt sett er det likevel gjort relativt lite forsøk på å generalisera resultata.

Dei prosessmodellane som er nytta, er så langt råd er bygt kring eit teoretisk fundament. I fleire tilfelle er det likevel gjort "kortsluttingar", fordi grunnlag og tid for ei meir detaljert skildring ikkje har vore tilstades.

Omfattande testing av modellane mot praktiske målingar har det ikkje vore høve til å gjennomføra.

b) Systemoptimalisering
Modellsystemet krev at brukaren spesifiserar flytskjemaet for det aktuelle reinseanlegget, og det er førebels ikkje lagt inn optimaliseringsrutiner for denne gitte kombinasjonen.

Det eksisterer heller ikkje rutiner for kombinasjon av prosessar ut frå gitte sluttkrav.

Økonomiske parametrar er heller ikkje med i denne omgang, men er lett å leggja inn i tilknytting til dei einskilde prosessane.

Trass i desse avgrensingane, vil programmet vera til hjelp for både planlegging, dimensjonering og driftsanalyse av reinseanlegg. På enkel måte får ein rekna massebalansar, og får verdiar for eit stort tal parametrar.

2. FÅR VI EIT SLAMPROBLEM I NOREG?

Interessa for behandling og disponering av slam frå kommunale reinseanlegg er aukande. For å setja ei grov råme kring omfang og storleiksorden, er det nedanfor gjort eit enkelt overslag.

2.1 Kommunalt slam i storleiken 130.000 tonn TS/år vil produserast ved århundreskiftet. 2/3 av dette slammet kjem frå reinseanlegg med meir enn 5000 p.e. tilknytta.

Når planlagde tiltak i norske byar og tettstader er gjennomførde, vil ein ved århundreskiftet produsera kloakkslam i storleiksorden 130.000 TS/år. Omlag 75 prosent av dette vil vera slam frå reinseanlegg med kjemisk felling i ei eller anna form.

Ut frå grunnlagsmaterialet til St.meld. 107 (1974-75) "Om arbeidet med en landsplan for bruken av vannressursene" (2) er kommunale reinseanlegg fordelt etter storleik år 2000 og synt i figur 1. Figur 2 syner grovt dei slammengdene som vi i gjennomsnitt kan rekna for kvart anlegg i dei ulike storleiksgruppane, og i figur 3 er dei totale slammengdene fordelt etter storleiken på reinseanlegga.

Vi kan gjera ein del interessante refleksjonar ut frå figurane. M.a. ser vi at reinseanlegg i gruppa over 5000 p.e. utgjer berre 13 prosent av det totale tal reinseanlegg, men står likevel for 65 prosent av dei slammengdene som blir produsert.

I så måte finn ein litt av grunnen til at slammet ofte blir sett på som eit problem. I større byar og tettstader der slammengdene blir store, er det også vanskelegast å finna eigna disponeringsform og -stad for produktet.

Det er store ønskje om å bruka slammet på jord- og skogareal, parkar og grøntanlegg, på vegfyllingar. Bruken av slammet er i dag underlagt restriksjonar frå helse- og veterinærstyresmakter, jordbruksinteresser og forureiningstilsyn. I kor stor grad slammet kan brukast vidare, er difor ikkje åleine bestemt av transportøkonomiske vurderingar, men av kvaliteten på slamproduktet ein får fram.

Fig.1. Renseanlegg fordelt på störrelse i år 2000.

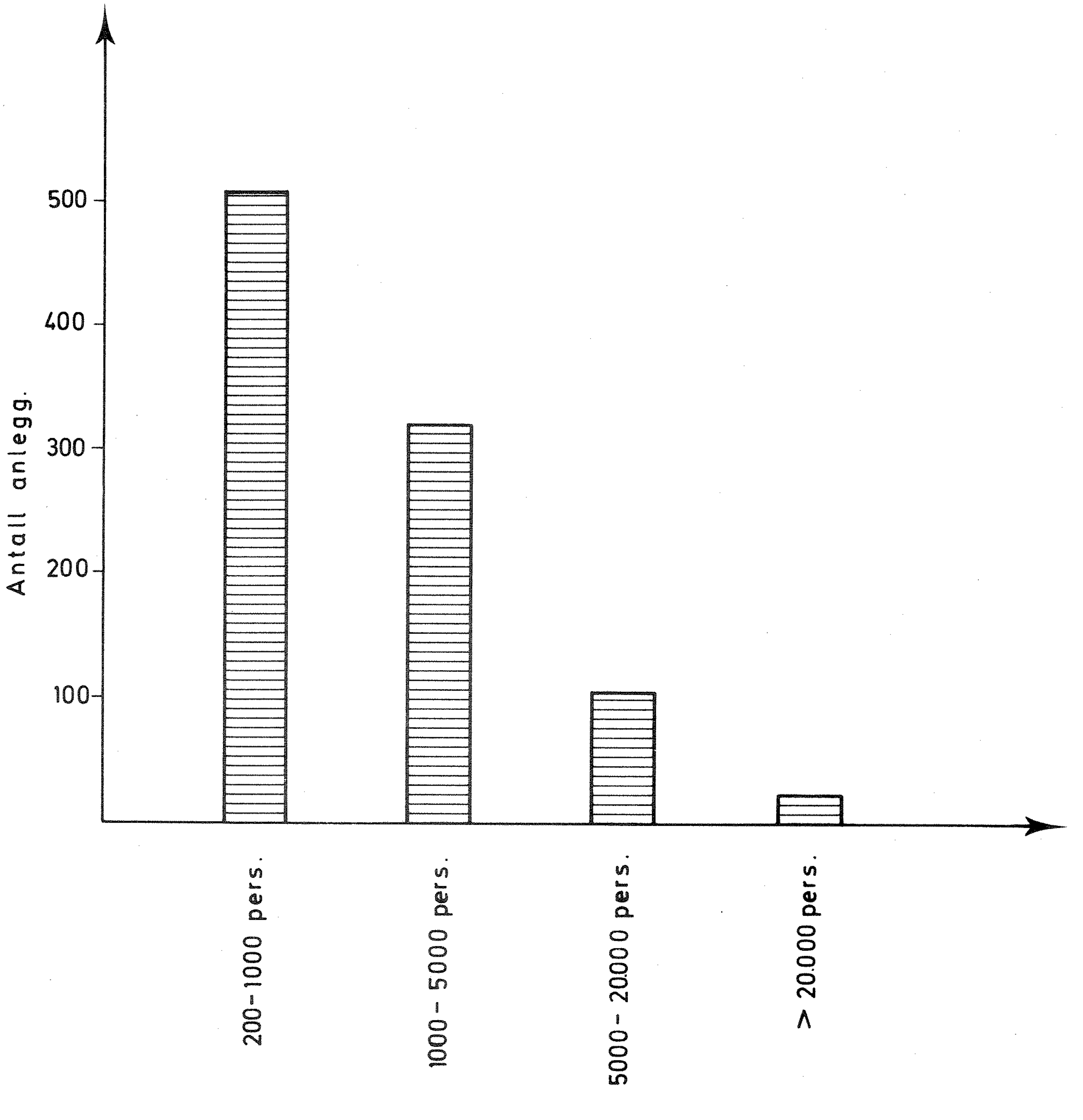
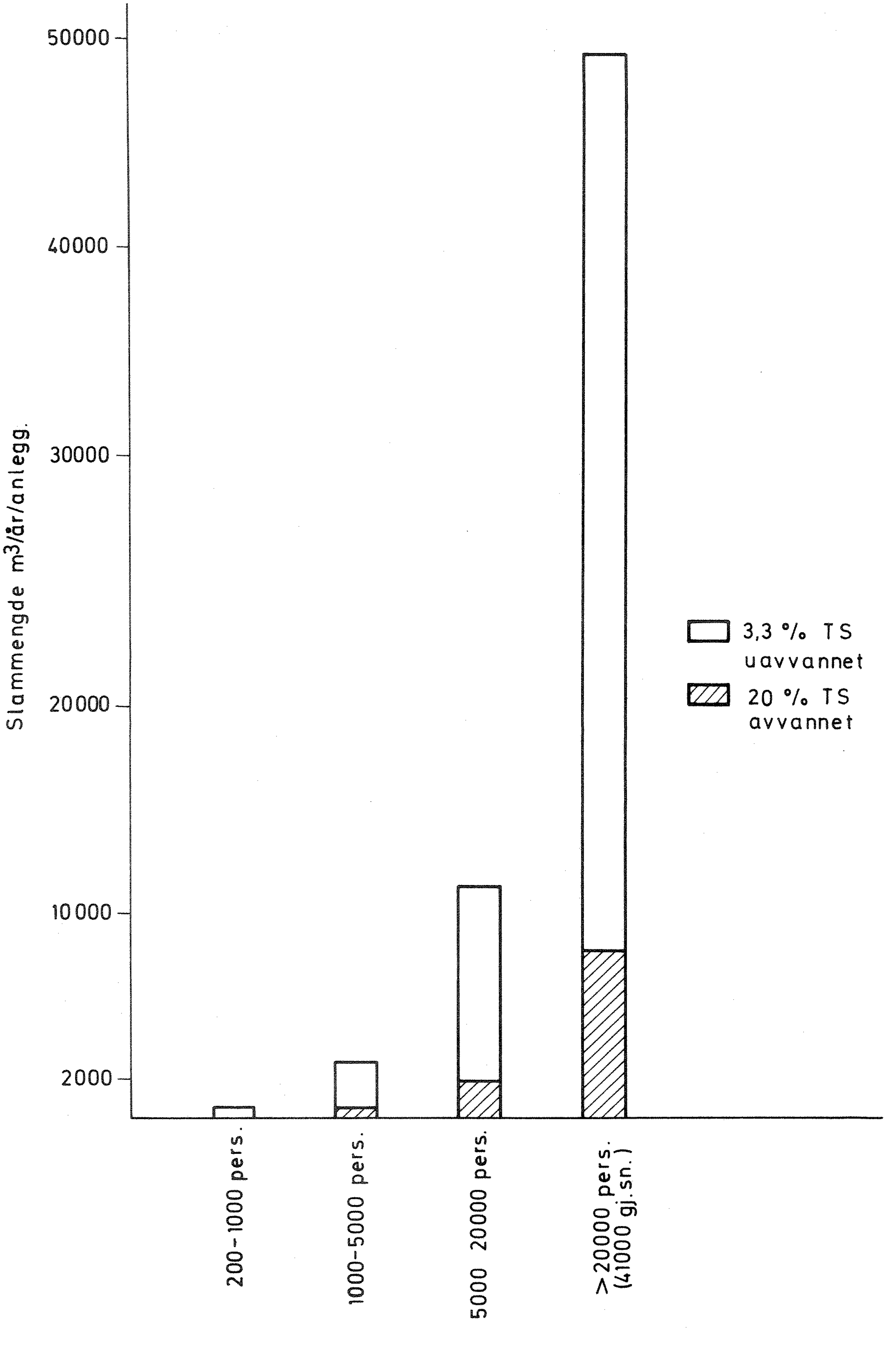


Fig. 2. GJENNOMSNITTLEG SLAMPRODUKSJON PR. ANLEGG I DEI ULIKE STORLEIKSGRUPPENE



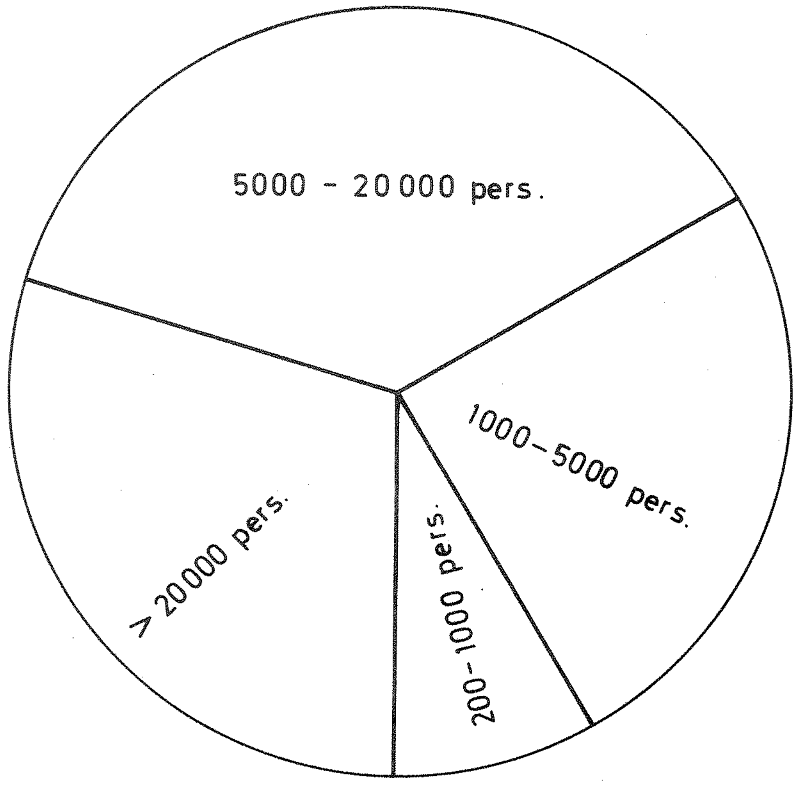


Fig. 3. Total slammengde, fordeling på renseanleggets störrelse.

Ønskjer ein derimot å leggja slammet bort - deponering, er dette først og fremst regulert gjennom helse- og forureiningstilsyn.

For å gje eit lite oversyn over to ytterpunkt for slamdisponering, bruk på dyrka mark og rein deponering i fylling, har vi sett på arealbehovet ved desse to bruksmåtane.

2.2 Disponering av slammet på jordbruksareal etter Helsedirektoratet si rettleiing krev store areal.

Helsedirektoratet har gjeve ut ei rettleiing til helseråda om m.a. bruk av slam på jordbruksareal (3).

Vi føreset at slammet har gått gjennom behandling som støttar Helsedirektoratet sine brukskrav. Dersom alt slammet frå reinseanlegg i ein del utvalde fylke år 2000 skal disponerast på jordbruksareal etter Helsedirektoratet si rettleiing (1 tonn TS/da/5 år), får vi følgjande arealbehov:

Tabell 1. Arealbehov ved slamdisponering på dyrka mark.

Arealbehov Fylke	% av fylket sitt totale areal	% av fylket sitt landbruksareal
Oslo/Akershus	3,6	23
Hedmark	0,15	4
Møre og Romsdal	0,3	8
Finnmark	0,03	20

Slik rettleiinga er forma i dag, fører den til at eit slam med 20% TS må leggjast ut i eit lag som er 1 mm tjukt, og det er sjølvsagt dette som er årsaka til dei store arealbehova.

2.3 Arealbehovet ved disponering på dyrka mark er jamført med deponering av 50 års akkumulert slamproduksjon

For reinseanlegg med 1000, 5000 og 50.000 p.e. tilknytta syner figur 4 arealbehovet ved disponering på jordbruksareal og rein deponering. Ved disponering har vi pårekna at 10 prosent av arealet kring reinseanlegget kan nyttast.

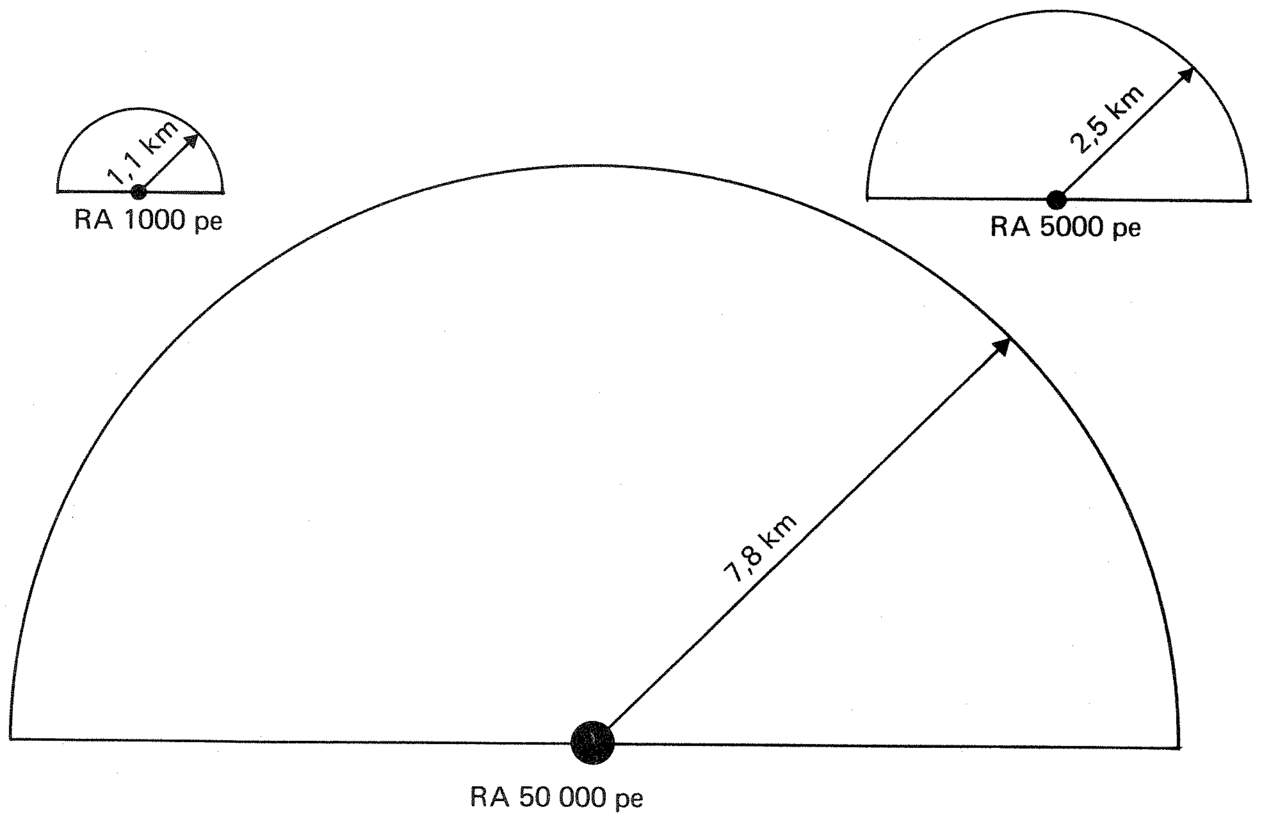
Ved deponering har vi pårekna avvatna slam med 20 prosent TS, og figur 5 syner kva areal som er nødvendig for å samla opp 50 års akkumulert slamproduksjon for ulike anleggsstorleikar, dersom vi legg slammet i 3 m høgd.

Figurane 4 og 5 kan vera nyttige for å setja det vi nemner "slamproblem" i rett perspektiv.

AREALBEHOV VED SPREIING PÅ DYRKA MARK.

10% AV AREALET KAN NYTTAST, TJUKN SLAMLAG 1MM

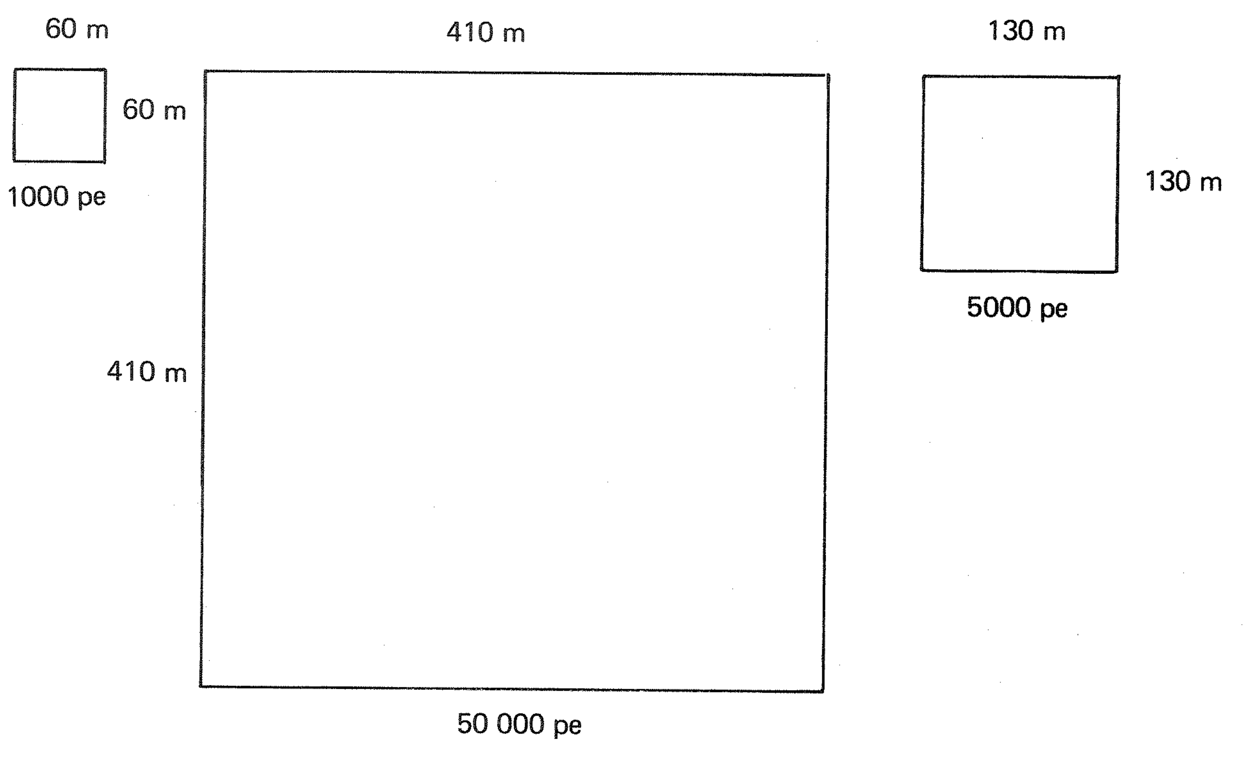
Fig. 4



AREALBEHOV VED DEPONERING AV SLAM - 20% TS -

50 ÅRS AKKUMULERT SLAMPRODUKSJON I 3 M HØGD

Fig. 5



3. FORSØK PÅ SYSTEMATISERING

3.1 Faktorar som påverkar slambehandlinga

Figur 6 syner det viktige samspelet mellom vass- og slambehandlinga i eit reinseanlegg.

Tradisjonelt er det sett krav til det reinsa avløpsvatnet ut frå resipient-vurderingar. Meir sjeldan er det slamproduktet som kjem fram ofra omtanke, og ordet "problem" er ofte nemnt.

Det ideelle er at ein set krav både til det reinsa avløpsvatnet og til det slamproduktet ein får fram, slik fig. 7 framstiller.

Vurdert med tanke på slamsida, kan figuren forklarast slik:

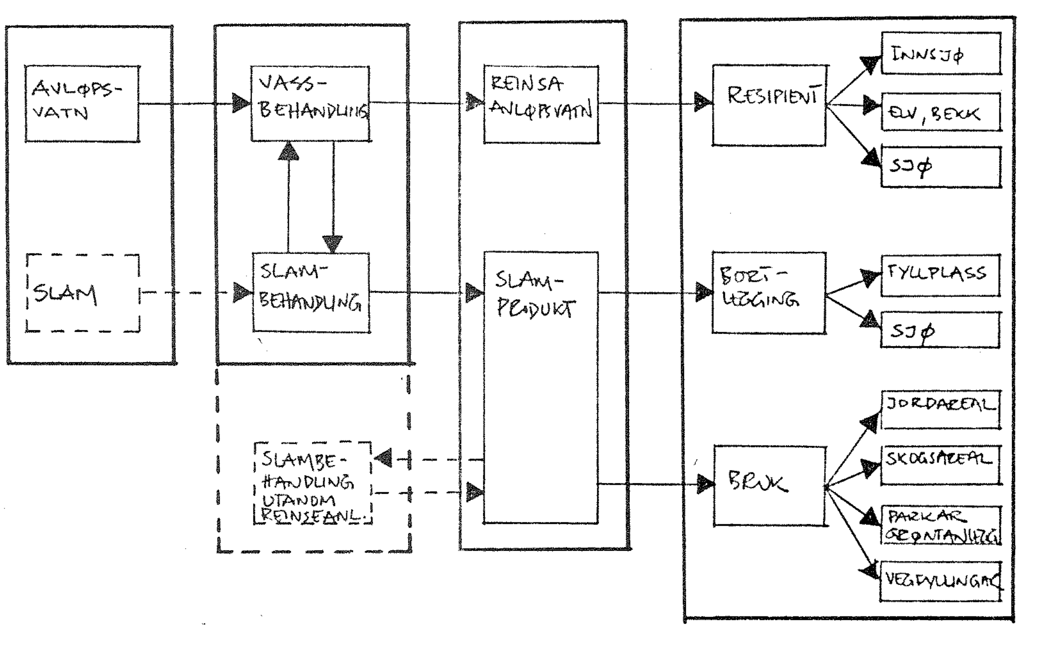


FIG. 6. SKISSE OVER SAMSPELET VASS- OG SLAMHANDTERING

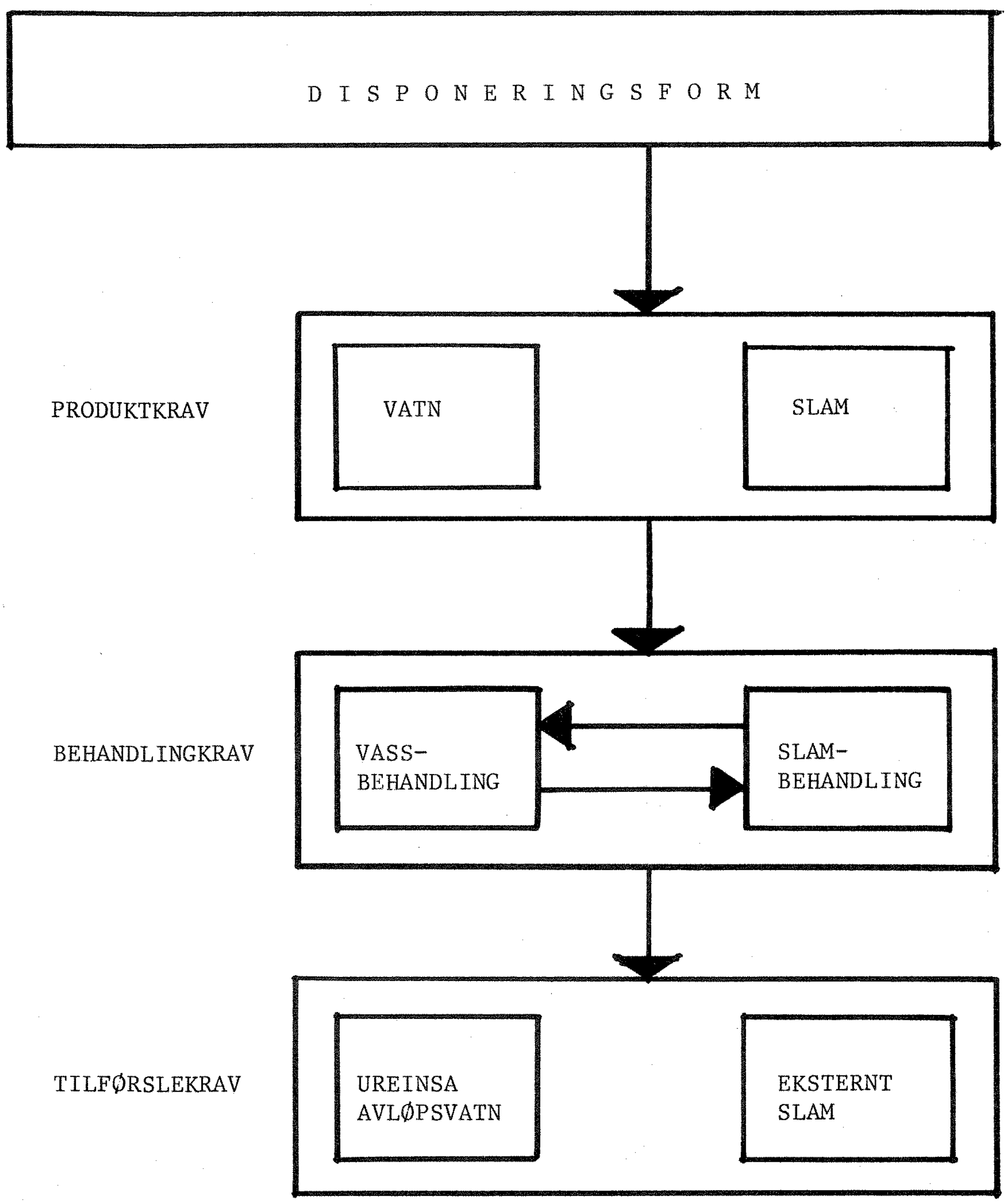


FIG. 7. SAMANHENG MELLOM SLAMDISPONERING OG SLAMBEHANDLING

Slammet frå kloakkreinseanlegg går til

a) bruk (i vid forstand)
b) bortlegging

Disponeringa av slamproduktet set såleis ulike krav til slameigenskapane. I prinsippet kan desse krava oppfyllast ved å stilla krav til slambehandlinga. Einskilde krav (m.a. tungmetallinnhald) kan likevel berre oppfyllast ved bruk av avanserte prosessar som er lite aktuelle for norske tilhøve. I staden er det difor naturleg å setja krav til kvaliteten av eksterne tilførsler.

Frå disponeringssynspunkt vil ein få fram eit sett av alternative slambehandlingsprosessar som kan oppfylla krava til slamproduktet. Andre tilhøve kan likevel krevja eliminering av nokre prosessar eller at andre prosessar vert sett inn i tillegg.

T.d. er det nært samband mellom slam- og vassbehandlinga i eit reinseanlegg. Slambehandlingsprosessane vil oftast gje eit slamvatn som vert ført tilbake til vassbehandlingsdelen, og i sin tur kan forstyrra vassprosessane. Som døme kan nemnast tilførsler av slamvatn frå eksternt septikslam, og slamvatn frå kalkstabilisering i kjemiske fellingsanlegg med aluminiumsulfat. Krava til vassbehandling stiller såleis eigne krav til slambehandlinga.

<u>Av dette går det fram at slamdisponeringa aleine ikkje er avgjerande for val av slambehandlingsprosessar.</u>

Etter vurderingane framanfor vil valet av slamhandtering koma fram som følgje av:

1) Krav til slameigenskapar, gitt av disponeringa. (Føresetnaden er at slameigenskapane kan endrast gjennom behandlingsprosessar).

2) Krav til vassbehandlinga, dvs. val av prosessar og omsynet til drift av desse.

3) Krav til tilførsler av tungmetall og andre miljøgifter (via eksternt slam- og avløpsvatn).

3.2 Krav til slamproduktet

Dei krava ein stiller, er ein funksjon av behov, tilgjengeleg teknologi og økonomiske utteljingar.

Om vi i det følgjande vurderer kun slamsida, kan vi oppsummera:

Behov

Krava byggjer på at ein skal gjera minst mogeleg skade på omgivnadene og er førebels regulert gjennom lover, føreskrifter, retningsliner m.v. Av dei viktigaste kan nemnast:

Tabell 2. Oversyn over lover, retningsliner m.v. som regulerer slamdisponeringa.

Regulert gjennom:	Gjeldande lover, føreskrifter m.v.
Helsestyresmakter	o Sunnhetsloven (1860) - forskrifter om oppbevaring av avfall og om renovasjon (1970) - forskrifter om hygieniske forhold i hytteområder o.l. (1970) - hygienisk vurdering av kloakkslam - en veiledning for helserådene (1976)
Arbeidsmiljøstyremakter	o Arbeidsmiljøloven m/føreskrifter
Landbruksstyremakter	o Plantesjukdomslova
Veterinærstyresmakter	o Husdyrlova
Miljøvernstyresmakter	o Lov om vern mot vannforurensning (1970) - retningsliner for deponering av kommunalt avfall i fylling (1978) - bygningslova (1965)

Av gjeldande reglar er det Helsedirektoratet si rettleiing ("Hygienisk vurdering av kloakkslam" (3)) som mest direkte regulerer bruken av slam. Statens forureiningstilsyn (SFT) har no under utarbeiding nye retningsliner for slamdisponering, og ein vil difor ikkje gå nærare inn på dette her.

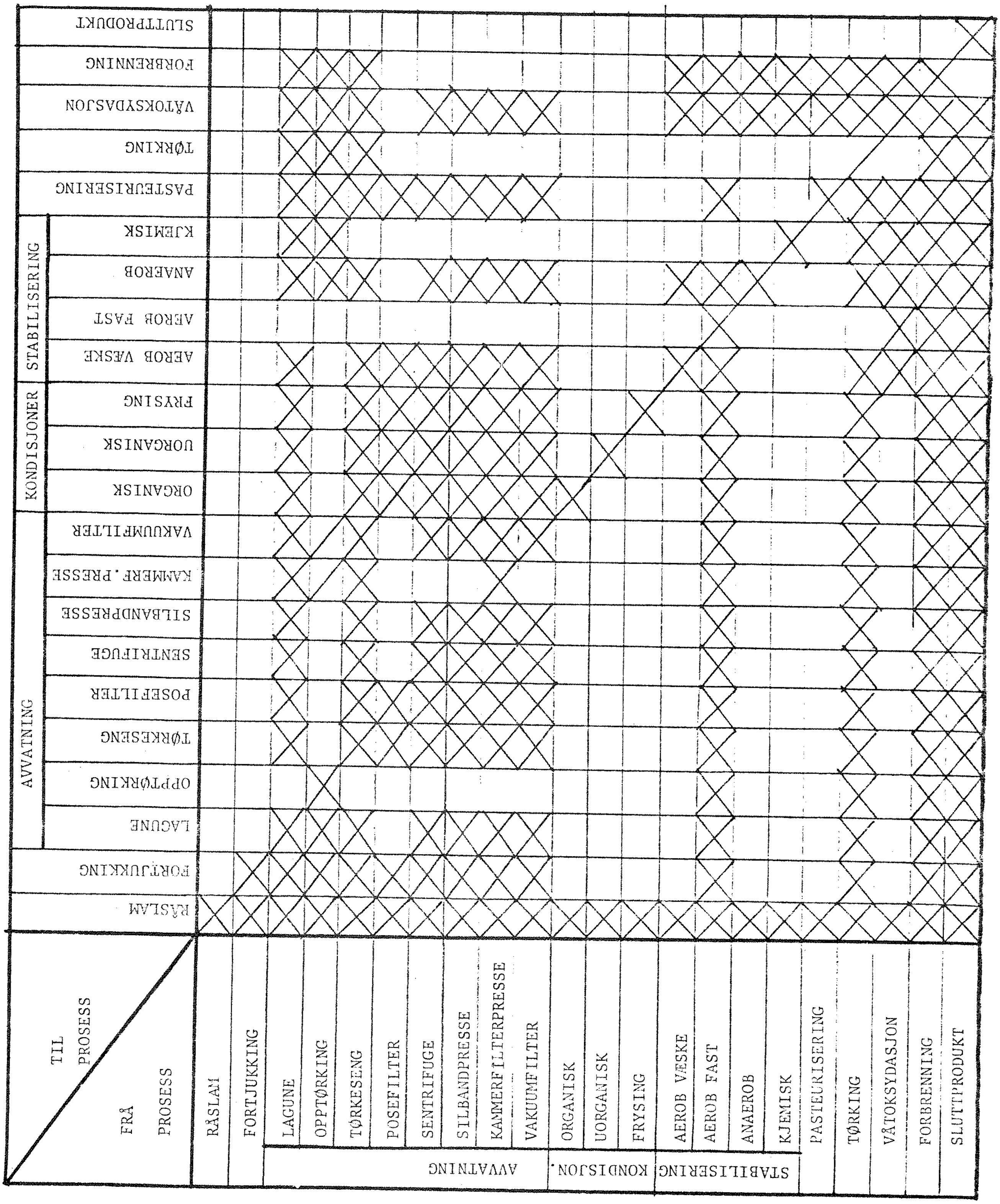
Tilgjengeleg teknologi

Mange prosessar er aktuelle for slambehandlinga. Tabell 3 syner dei prosessane og prosesskombinasjonane som kan reknast bli vurdert i Noreg. Prosesskombinasjonane er gjort ut frå ei skjønnsmessig vurdering. Openberre umogelege kombinasjoner er utelatne (som t.d. forbrenning før fortjukking.)

Økonomi

Legg vi skjønsmessige økonomiske vurderingar til grunn, attåt ei vurdering av eksisterande praksis, vil vi truleg enda opp med ei prosessmatrise som i tabell 4. Denne matrisa inneheld ei vurdering av prosessane i tabell 3, og utgjer det utvalet av slambehandlingsprosessar som vi i dag vurderer som mest aktuelle for våre norske, heller små anlegg. Forbehandlingsprosessar er sjølvsagt aktuelle, men er ikkje med i matrisa.

Tabell 3. Aktuelle slambehandlingsprosessar og prosesskombinasjonar. Opne ruter angir aktuelle kombinasjonar.



Tabell 4. Dei mest aktuelle slambehandlingsprosessane og prosesskombinasjonane.
Opne ruter angir aktuelle kombinasjonar.

FRÅ PROSESS \ TIL PROSESS				STABILISERING				KONDI-SJONERING		AVVATNING			
		RÅSLAM	FORTJUKKING	ANAEROB VÆSKE	AEROB VÆSKE	KALK	AEROB FAST	ORGANISK	UORGANISK	KAMMERFILTER	SILBANDPRESSE	SENTRIFUGE	SLUTTPRODUKT
RÅSLAM		X					X						
FORTJUKKING		X	X				X						
STABILI-SERING	ANAEROB VÆSKE	X		X	X	X	X						
	AEROB VÆSKE	X		X	X	X	X						
	KALK	X		X	X	X							
	AEROB FAST	X	X	X	X	X	X	X	X	X	X	X	
KONDISJON-ERING	ORGANISK	X		X	X	X	X	X	X				
	UORGANISK	X		X	X	X	X	X	X				
AVVATNING	KAMMERFILTER	X	X	X	X	X		X	X	X	X	X	
	SILBANDPRESSE	X	X	X	X	X		X	X		X		
	SENTRIFUGE	X	X	X	X	X		X	X			X	
SLUTTPRODUKT		X	X	X	X	X	X	X	X	X	X	X	X

3.3 Karakterisering av slamproduktet

I punkt 3.2 er krav til slamproduktet nytta som stikkord. Skal desse krava vera til hjelp i planlegging og dimensjonering av slambehandlingsanlegg, må dei både klassifiserast og kvantifiserast.
Sett frå kun disponeringssynsstad, kan hovudklassifikasjonen vera som i tabell 5.

Tabell 5. Hovudklassifikasjon av disponeringskrav.

HOVUDASPEKT	UTTRYKT VED PARAMETER	VURDERING AV MÅLESKALA		
		OBJEKTIV	UKLAR	SUBJEKTIV
HANDTERING	VOLUM	X		
	TØRRSTOFF	X		
	STRUKTUR	(X)		X
HYGIENE HELSEVERN	VIRUS, BAKTERIAR, PARASITTAR		X	X
	TUNGMETALL	X		
PÅVERKNAD AV OMGJEVNADER	LUKT - TYPE			X
	- INTENSITET	(X)		X
	AVRENNING - MENGDE	X		
	- KVALITET	X		
ANDRE BRUKSKRAV	ORGANISK MATERIALE	X		
	NÆRINGSEMNE	X		
	PLANTEVERN		X	X

Tabell 5 byggjer på subjektive vurderingar. Tabellen syner likevel ein del av spennvidda når det gjeld slamkarakterisering. For handterings-parameteren struktur kan vi operera med omgrep som spabar, pulveraktig m.v., men sjølve parameteren er vanskeleg å talfesta objektiv.

Helseparametrane virus, bakteriar og parasittar er også dels tvilsame. Måleteknisk er det vanskeleg å få fram reproduserbare verdiar, og det vil mest alltid bli nødvendig med ei grov subjektiv vurdering av desse tilhøva. Luktparametrane er viktige, men er i tabellen klassifisert som subjektive på måleskalaen. Det same gjeld delvis plantevern.
Sjølv om parametrar ikkje kan kvantifiserast direkte, er dei like viktige for det. Ei rein subjektiv, relativ vurdering er sjølvsagt ikkje så akademisk tilfredsstillande, men er fullt mogeleg.

Tabell 6 syner eit parametersett som er nytta i modellen presentert i del B av denne rapporten. Parametrane er valde ut frå det totalsystemet som er forsøkt skildra, og ein del parametrar som er turvande for vass-fasen er med.

Tabell 6. Parametersett for skildring av slamkvalitet.

PARAMETER	EINING	PARTIKULÆRT MATERIALE	LØYST MATERIALE
Suspendert stoff	kg/m^3	x	
Flyktig suspendert stoff	kg/m^3	x	
Biokjemisk oksygen-forbruk	kg/m^3	x	x
Fosfor	kg/m^3	x	x
Nitrogen	kg/m^3	x	x
Kadmium	g/m^3	x	x
Kvikksølv	g/m^3	x	x
Bly	g/m^3	x	x
Kalsium	kg/m^3	x	x
Magnesium	kg/m^3	x	x
Alkalitet	ekv./m^3		x
pH			x
Hygiene	-	x	
Lukt	-	x	
Plantevern	-	x	

Ein merkar seg at parametrane hygiene, lukt og plantevern er føreslått gitt talverdiar etter ein subjektiv skala.

3.4 Endringar av karakteristika i prosessane

Alle slambehandlingsprosessar har til føremål å endra ein eller fleire karakteristika ved slammet. I kor stor mon desse endringane er avhengig av det slammet som kjem inn til prosessen, varierer frå prosess til prosess. Det er førebels sett mest tenleg å bruka kun parametrar som har praktisk verdi, og det tyder difor at t.d. kondisjonerings og avvatningsprosessar har fått ei relativt enkel behandling vidare i denne rapporten (del B).

4. PLANLEGGING PÅ ULIKE NIVÅ

4.1 Typiske planleggingsfasar

Planleggings- og dimensjoneringsoppgåver for reinseanlegg m/slambehandling kan delast inn slik tabell 7 syner:

Tabell 7 Planleggingsnivå

Nivå	Føremål	Døme på aktuelle "verktøy"
1	Jamføring av hovudalternativ	Enkle materialbalanse-modellar Enkle optimaliseringsmodellar
2	Førebels dimensjonering Prosessvurdering	Enkle optimaliserings- og simuleringsmodellar
3	Vurdere drifts-rutiner, drifts-optimalisering	Detaljerte, dynamiske prosessmodellar

4.2 Materialbalanseopplegg

Eit kjernepunkt i alt som har med slam å gjera, er sjølvsagt produksjons leddet. Det er ved og i reinseanlegget ein har dei beste tilhøva for å påverka produktkvaliteten.

Difor er det absolutt turvande å vita: Kor mykje slam blir produsert ved ulike prosessar, og korleis er samspelet mellom vass- og slambehandling? Bruker vi slambehandlingsprosessar som påverkar vassfasen negativt?

Dette er bakgrunnen for at arbeidet har vore konsentrert om reinseanlegget, og at materialbalanser der står så sentralt.

5. REFERANSAR

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Delrapport 1: Slamproduksjon
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Arbeidsrapport nr. 1: Kostnader for tiltak i byer og tettsteder, spredt i boligbebyggelse, fritidsbebyggelse m.v. O-150/73 NIVA (1975)

3. Helsedirektoratet, hygienekontoret:
Hygienisk vurdering av kloakkslam.
En veiledning til helserådene (1976).

4. Lygren, Eivind et. al: Disponering av avvannet slam.
Sigevannsproblemer ved lagring av ulike slamtyper.
UFA-prosjekt 4.3.18, O-103/77 NIVA (1978)

PART B

USER'S GUIDE FOR THE COMPUTER MODEL PROGRAM PREDES

LIST OF CONTENTS

1. OBJECTIVES FOR PROGRAM DEVELOPMENT

The model program PREDES (Preliminary Design of Wastewater Treatment Systems) is developed to fulfill the following objectives:

- mass balance calculations for treatment plants, based on a steady state condition for continously working treatment processes

- calculation of dimensions for the different process units, based on design criteria given by the user

Another objective has been to make the program system flexible and self-explaining; i.e. develop an interactive program version.

2. SPECIAL CHARACTERISTICS

2.1 Flow chart

For each treatment process configuration, the user has to specify the flow chart for the system. Also recycling streams from sludge treatment processes can be considered.

The processes and the sludge and water streams should be assigned numbers for identification, as shown in the example in pt. 5.

2.2 Design flow rates

The design flow rates for a treatment plant are given in the form recommended by the Norwegian guidelines for design of wastewater treatment plants. According to this recommendation, two flow rates are necessary:

a) Design flow rate	Qdim	(m3/h)
b) Maximum design flow rate	Qmaxdim	(m3/h)

These flow rates can be given explisitly, or calculated from the following formulaes:

c) Qdim = qs*p/Ts + qi*p/24 + Qind/Tind (m3/h)

d) Qmaxdim = f * Qdim (m3/h)

where

qs	= mean sewage flow per capita per day	(m3/cap/day)
qi	= mean infiltration flow per capita per day	(m3/cap/day)
Qind	= industrial wastewater flow per day	(m3/day)
p	= person equivalents connected to the plant	(cap)
Ts	= hours, over which the sewage flow is distributed	(h)

If Ts is not given explisitly, it will be calculated from

Ts = 24./(1. + 31.5/sqrt(p))

Tind	= number of hours, over which the industrial flow is distributed	(h)
f	= multiplier, giving the ratio Qmaxdim/Qdim	(h)

All the water treatment processes are designed according to the values for Qdim and Qmaxdim. Sludge treatment processes are designed partly based on values from the mass balance calculations.

2.3 Stream characteristics

Each of the sludge and water streams are characterized by the following parameters;

Flow rate	m3/h	Q	
Concentrations of		Fraction	
		Particulate	Dissolved
Suspended solids	kg/m3	SS/P	
Volatile susp. solids	kg/m3	VSS/P	
Biochemical oxygen demand	kg/m3	BOF7/P	BOF7/D
Phosphorus	kg/m3	P/P	P/D
Nitrogen	kg/m3	N/P	N/D
Cadmium	g/m3	CD/P	CD/D
Mercury	g/m3	HG/P	HG/D
Lead	g/m3	PB/P	PB/D
Calsium	kg/m3	CA/P	CA/D
Magnesium	kg/m3	MG/P	MG/D
Alkalinity	eq/m3		ALK/D
pH			PH/D

SPECIAL PARAMETERS FOR SLUDGE;

Hygiene	0 - 10	HYGIENE
Odor	0 - 10	ODOR
Plant protection	0 - 10	PPROT

The special parameters are assigned to the sludge streams on a subjective scale, ranging from 0 to 10. The index 10 is used for the least satisfactory quality. Increased quality is indicated by a decreasing index number.

For the water treatment processes, the special sludge quality indexes are given as default values by the program, as follows;

	Hygiene	Odor	Plant protec.
Primary sedimentation	8.	8.	8.
Chemical precipitation			
Alum	5.	5.	7.
FeCl3	5.	5.	7.
Lime	3.	3.	5.

Sludge quality indexes should be given explisitly for external sludge input.

For the sludge treatment processes, the changes in quality indexes are given as per cent improvement (reduction). The default values given in the program:

	Per cent reduction		
	Hygiene	Odor	Plant prot.
Preliminary treatment	0.0	0.0	0.0
Sludge thickening	0.0	0.0	0.0
Sludge dewatering	0.0	0.0	0.0
Stabilization			
Aerobic	40.0	90.0	10.0
Lime	80.0	20.0	20.0

3. PROCESS DESCRIPTION

The following unit processes are implemented in the 1. version of the program PREDES;

Water treatment

PREWAT - Preliminary treatment
PRISED - Primary sedimentation
CHEMAL - Chemical precipitation/alum
CHEMFE - Chemical precipitation/Fe(III)
CHEMCA - Chemical precipitation/lime and seawater

Sludge treatment

PRESLU - Preliminary treatment of external sludge
THICK - Gravity thickening
STAAER - Aerobic sludge stabilization
STALIM - Lime stabilization
CENTRI - Sludge dewatering

Combined processes

MIX - A mixing device
SPLIT - A splitting device

As seen from the list, biological water treatment processes are not implemented in this 1. program version.
For sludge treatment options, sludge holding tanks, anaerobic stabilization, conditioning and the composting process are not implemented.

The conditioning process is implisitly taken care of by the users control of the dewatering process CENTRI.
The composting process itself do not interfere with the treatment process by producing sludge water for recycling, and hence do not cause any treatment problems.

As the system configuration is, processes can be added or deleted in a simple way.

On the following pages, each of the treatment processes is described in alphabetic order. For the user's benefit, an instructive example is shown for each of them.

Process Identification

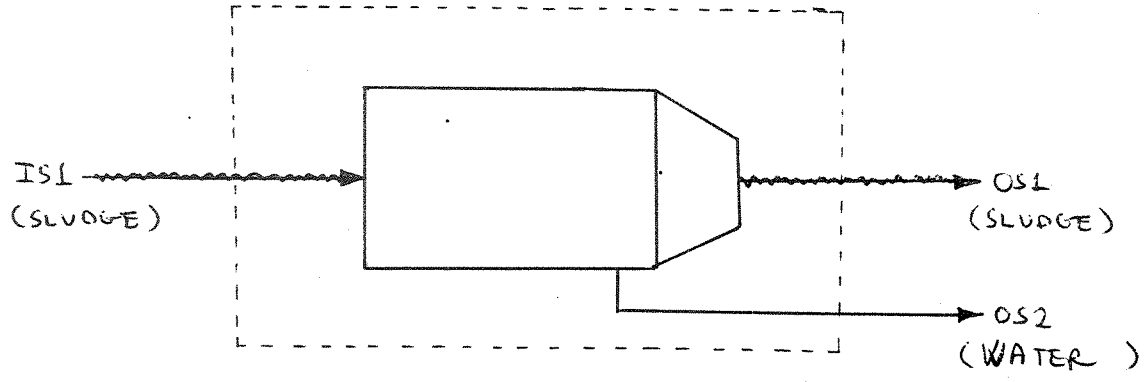
P R O C E S S **Centri**

PROCESS NAME: SLUDGE DEWATERING - CENTRIFUGATION

Process Description

A dewatering process, in which the suspended solids concentration in the sludge stream are considerably increased.

Process Sketch



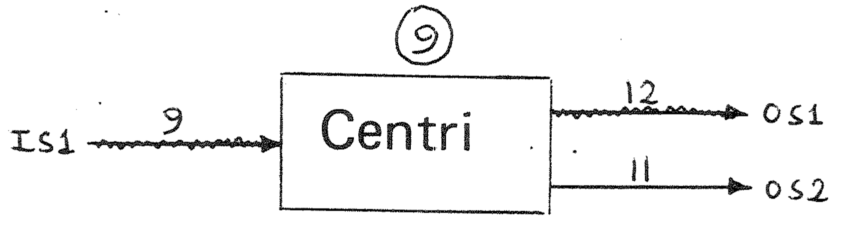
Process Flows

PRINCIPAL INPUT STREAM NUMBER (IS1) : SLUDGE INPUT
SECOND INPUT STREAM NUMBER (IS2) : ———
PRINCIPAL OUTPUT STREAM NUMBER (OS1) : SLUDGE OUTPUT
SECOND OUTPUT STREAM NUMBER (OS2) : WATER OUTPUT

Process Characteristics

Name	Unit	Option	
SOLIDS RECOVERY RATIO FOR CENTRIFUGATION		M1	(1)
SUSPENDED SOLIDS CONCENTRATION OF SLUDGE OUTPUT STREAM	(KG/M3)	M2	(2)

Specification Example




```
==========     P R O C E S S   IDENTIFICATION

     PROCESS NUMBER (N)  : 9
     PROCESS NAME        : CENTRI

==========     E N D IDENTIFICATION

?                    DO YOU WANT TO SPECIFY PROCESS FLOW? Y

==========     P R O C E S S   FLOW

     PRINCIPAL INPUT STREAM NUMBER   (IS1) : 9
     SECOND INPUT STREAM NUMBER      (IS2) : 0

     PRINCIPAL OUTPUT STREAM NUMBER (OS1) : 12
     SECOND OUTPUT STREAM NUMBER    (OS2) : 11

==========     E N D   FLOW

?                    DO YOU WANT TO GIVE PROCESS CHARACTERISTICS? Y

==========     P R O C E S S   CHARACTERISTICS

     PROCESS NAME:   CENTRI

     SOLIDS RECOVERY RATIO FOR CENTRIFUGATION                       : 0.95
     SUSPENDED SOLIDS CONCENTRATION OF SLUDGE
     OUTPUT STREAM                               (KG/M3)            : 200.

==========     E N D   CHARACTERISTICS
```

Process Model

A. ASSUMPTIONS

1. No changes in the concentrations of dissolved matter.
2. Particulate matter concentrations in the output streams are proportional to the suspended solids concentrations.
3. Different specific gravity in the output streams are not accounted for.

B. MODEL PRINCIPLES

1. Dissolved matter concentrations: Output=Input
2. Particulate matter:

   a) A mass balance on suspended solids, giving the flow rates for the water effluent and the sludge stream.

   b) The concentrations of the constituents connected to suspended solids are calculated from mass balances, in which the principle of homogeneous mixing are applied.

3. Special parameters for sludge quality in the output sludge stream are set equal to the input values.

Process Identification

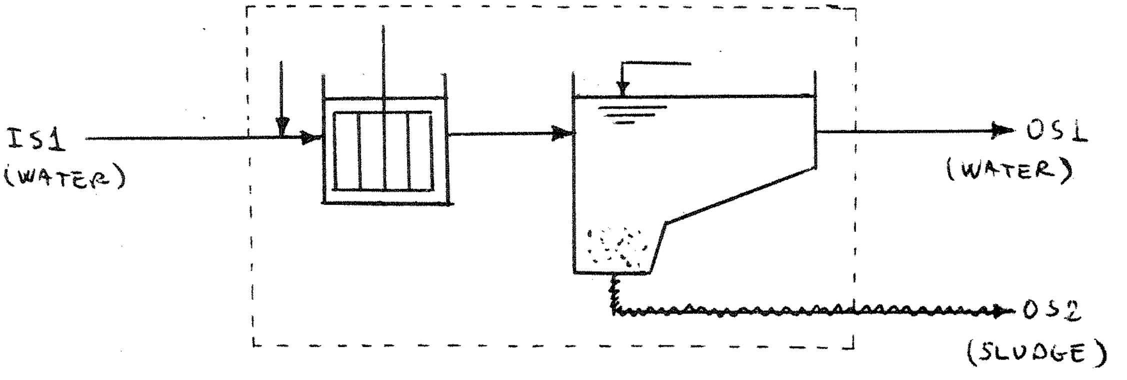
PROCESS **Chemal**

PROCESS NAME: CHEMICAL PRECIPITATION BY ALUM

Process Description

Chemical precipitation by alum, Al2(SO4)3*18H2O, including chemical addition, coagulation, flocculation and gravity sedimentation.

Process Sketch



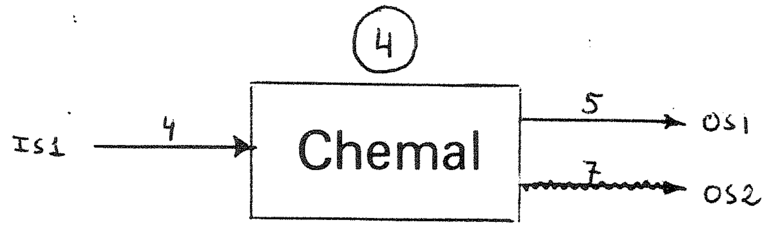
Process Flows

PRINCIPAL INPUT STREAM NUMBER	(IS1) :	WATER INPUT
SECOND INPUT STREAM NUMBER	(IS2) :	———
PRINCIPAL OUTPUT STREAM NUMBER	(OS1) :	WATER OUTPUT
SECOND OUTPUT STREAM NUMBER	(OS2) :	SLUDGE OUTPUT

Process Characteristics

Name	UNIT	Option	
CHEMICAL ADDITION			
PRECIPITATION PH		M1-A	(1)
DOSE OF ALUM	(G/M3)	M1-B	(2)
RATIO AL/TOT-P	(MOL/MOL)	M1-C	(3)
* FLOCCULATION			
TEMPERATURE	(DEG C)	M2	(4)
NUMBER OF CHAMBERS		M3	(5)
TOTAL DETENTION TIME AT QDIM	(MIN)	M4	(6)
* SEDIMENTATION BASIN			
OVERFLOW RATE AT QDIM	(M3/M2/H)	M5-A	(7)
AT QMAXDIM	(M3/M2/H)	M5-A	(8)
TOTAL AREA	((10**3)*M2)	M5-B	(9)
DETENTION TIME AT QDIM	(H)	M6-A	(10)
DEPTH	(M)	M6-B	(11)
VOLUME	((10**3)*M3)	M6-C	(12)
SUSPENDED SOLIDS CONCENTRATIONS:			
WATER EFFLUENT (WHEN PREFIXED)	(KG/M3)	M7	(13)
CHEMICAL SLUDGE	[illegible]	M8	(14)

Specification Example




```
==========     P R O C E S S   IDENTIFICATION

     PROCESS NUMBER (N) : 4
     PROCESS NAME       : CHEMAL

==========     E N D  IDENTIFICATION

?                    DO YOU WANT TO SPECIFY PROCESS FLOW? Y

==========     P R O C E S S   FLOW

     PRINCIPAL INPUT STREAM NUMBER    (IS1) : 4
     SECOND INPUT STREAM NUMBER       (IS2) : 0

     PRINCIPAL OUTPUT STREAM NUMBER  (OS1) : 5
     SECOND OUTPUT STREAM NUMBER      (OS2) : 7

==========     E N D   FLOW

?                    DO YOU WANT TO GIVE PROCESS CHARACTERISTICS? Y

==========     P R O C E S S   CHARACTERISTICS

     PROCESS NAME:   CHEMAL

* CHEMICAL ADDITION
     PRECIPITATION PH                                          : 5.9

* FLOCCULATION
     TEMPERATURE                              (DEG C)          : 10.
     NUMBER OF CHAMBERS                                        : 3.
     TOTAL DETENTION TIME AT QDIM             (MIN)            : 30.

* SEDIMENTATION BASIN
     OVERFLOW RATE AT QDIM                    (M3/M2/H)        : 1.3
                   AT QMAXDIM                 (M3/M2/H)        : 2.0
     DETENTION TIME AT QDIM                   (H)              :
     DEPTH                                    (M)              : 2.5

     SUSPENDED SOLIDS CONCENTRATIONS:
          WATER EFFLUENT (WHEN PREFIXED)      (KG/M3)          : 0.015
          CHEMICAL SLUDGE                     (KG/M3)          : 7.5

==========     E N D   CHARACTERISTICS
```

Process Model

A. ASSUMPTIONS

1. The precipitation products are the inorganic components AlPO4 and Al(OH)3.

2. For the given suspended solids concentration in the output streams, the concentrations of other particulate constituents are calculated proportional to suspended solids.

3. The change in specific gravity in the sludge stream are not accounted for.

4. The dissolved matter concentrations in the water effluent are fixed to a given per centage of influent concentrations.

B. MODEL PRINCIPLES

1. The precipitation process is based on pH and alkalinity, as follows;

   a) Intermediate pH and alkalinity, resulting from AlPO4-precipitation.

   b) Final pH and alkalinity after Al(OH)3-precipitation.

2. Concentration changes of dissolved matter are calculated for the following constituents only, for which the fractional removal (normal municipal wastewater assumed) are fixed to;

   P/D = 0.95
   CD/D = 0.95
   HG/D = 0.50
   PB/D = 0.95

3. Particulate matter concentrations are based on mass balances.

4. Special parameters for sludge quality are fixed as follows;

   HYGIENE : 5.
   ODOR : 5.
   PPROT : 7.

Process Identification

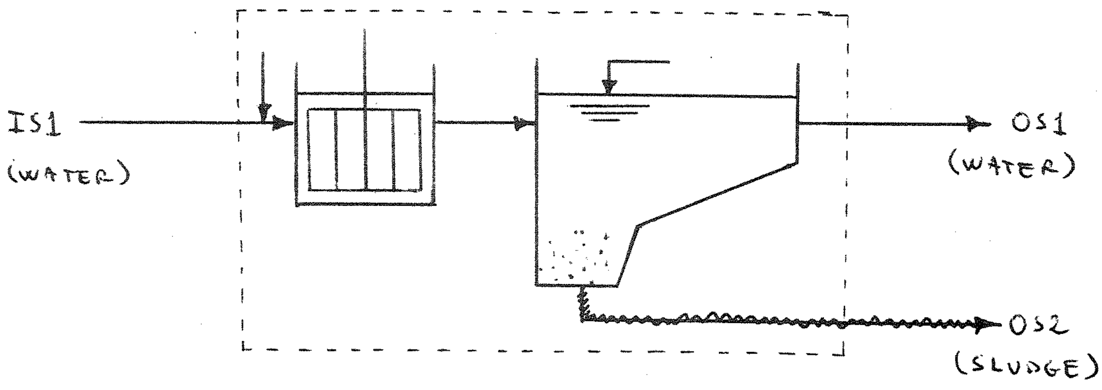
PROCESS **Chemca**

PROCESS NAME: CHEMICAL PRECIPITATION BY LIME AND SEAWATER

Process Description

Chemical precipitation by Ca(OH)2, or by Ca(OH)2 and seawater addition. The process includes addition of chemicals (and seawater), coagulation, flocculation and gravity sedimentation.

Process Sketch



Process Flows

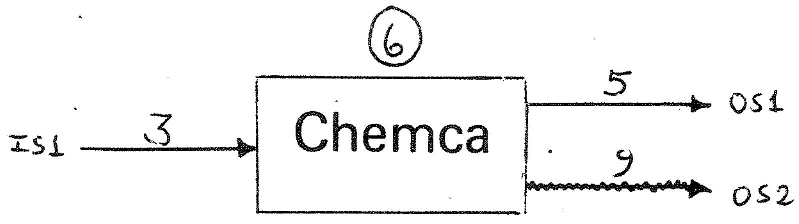
PRINCIPAL INPUT STREAM NUMBER (IS1) : WATER INPUT
SECOND INPUT STREAM NUMBER (IS2) : ———

PRINCIPAL OUTPUT STREAM NUMBER (OS1) : WATER OUTPUT
SECOND OUTPUT STREAM NUMBER (OS2) : SLUDGE OUTPUT

Process Characteristics

Name	Unit	Option	
* CHEMICAL ADDITION			
PRECIPITATION PH		M1	(1)
DOSE OF CA(OH)2	(G/M3)	M2	(2)
VOLUME FRACTION SEAWATER/INFLOW	(%)	M3-A	(3)
SEAWATER SALINITY	(PR.MI..)	M3-A	(4)
* FLOCCULATION			
TEMPERATURE	(DEG C)	M4	(5)
NUMBER OF CHAMBERS		M5	(6)
TOTAL DETENTION TIME AT QDIM	(MIN)	M6	(7)
* SEDIMENTATION BASIN			
OVERFLOW RATE AT QDIM	(M3/M2/H)	M7-A	(8)
AT QMAXDIM	(M3/M2/H)	M7-A	(9)
TOTAL AREA	((10**3)*M2)	M7-B	(10)
DETENTION TIME AT QDIM	(H)	M8-A	(11)
DEPTH	(M)	M8-B	(12)
VOLUME	((10**3)*M3)	M8-C	(13)
SUSPENDED SOLIDS CONCENTRATIONS:			
WATER EFFLUENT (WHEN PREFIXED)	(KG/M3)	M9	(14)
CHEMICAL SLUDGE	(KG/M3)	M10	(15)

Specification Example




```
==========     P R O C E S S   IDENTIFICATION

     PROCESS NUMBER (N)  : 6
     PROCESS NAME        : CHEMCA

==========     E N D IDENTIFICATION

?                   DO YOU WANT TO SPECIFY PROCESS FLOW? Y

==========     P R O C E S S   FLOW

     PRINCIPAL INPUT STREAM NUMBER   (IS1) : 3
     SECOND INPUT STREAM NUMBER      (IS2) : 0

     PRINCIPAL OUTPUT STREAM NUMBER (OS1) : 5
     SECOND OUTPUT STREAM NUMBER    (OS2) : 9

==========     E N D  FLOW

?                   DO YOU WANT TO GIVE PROCESS CHARACTERISTICS? Y


==========     P R O C E S S   CHARACTERISTICS

     PROCESS NAME:  CHEMCA


* CHEMICAL ADDITION
     PRECIPITATION PH                                            : 11.4
     DOSE OF CA(OH)2                          (G/M3)             :
     VOLUME FRACTION SEAWATER/INFLOW          (%)                : 5.
     SEAWATER SALINITY                        (PR.MILL)          : 30.

* FLOCCULATION
     TEMPERATURE                              (DEG C)            : 13.
     NUMBER OF CHAMBERS                                          : 4
     TOTAL DETENTION TIME AT QDIM             (MIN)              : 15.

* SEDIMENTATION BASIN
     OVERFLOW RATE AT QDIM                    (M3/M2/H)          : 1.6
                   AT QMAXDIM                 (M3/M2/H)          : 2.4
     DETENTION TIME AT QDIM                   (H)                :
     DEPTH                                    (M)                : 2.5



     SUSPENDED SOLIDS CONCENTRATIONS:
          WATER EFFLUENT (WHEN PREFIXED)      (KG/M3)            : 0.025
          CHEMICAL SLUDGE                     (KG/M3)            : 50.

==========     E N D  CHARACTERISTICS
```

Process Model

A. ASSUMPTIONS

1. The precipitation products are the inorganic components Ca10(PO4)6*(OH)2, Mg(OH)2 and CaCO3.

2. For given suspended solids concentrations in the output streams, the concentrations of other particulate constituents are calculated proportional to suspended solids.

3. The change in specific gravity in the sludge stream is not accounted for.

4. The dissolved matter concentrations in the water effluent are fixed to a given per centage of the influent concentrations.

B. MODEL PRINCIPLES

1. The theoretical necessary dose of Ca(OH)2 to obtain the given precipitation pH are calculated from;

   a) increase in concentration of free OH-ions
   b) displacement of equlibrium in the carbonate system
   c) displacement of equlibrium in the system NH4 - NH3
   d) displacement of equlibrium of phosphates
   e) precipitation of Ca10(PO4)6 * (OH)2
   f) precipitation of Mg(OH)2

2. The precipitation of CaCO3 is based on an equlibrium around the Ca-ion.

3. If the actual dose of Ca(OH)2 exeeds the theoretical dose calculated in B1, the difference is accounted for in the sludge production as unused lime.

4. Concentration changes of dissolved matter are calculated for the following constituents only, for which the fractional removal (normal municipal wastewater assumed) are fixed to;

   P/D = 0.95
   CD/D = 0.95
   HG/D = 0.50
   PB/D = 0.95

5. Particulate matter concentrations are based on mass balances.

6. Special parameters for sludge quality are fixed as follows;

   HYGIENE : 3.
   ODOR : 3.
   PPROT : 5.

Process Identification

PROCESS

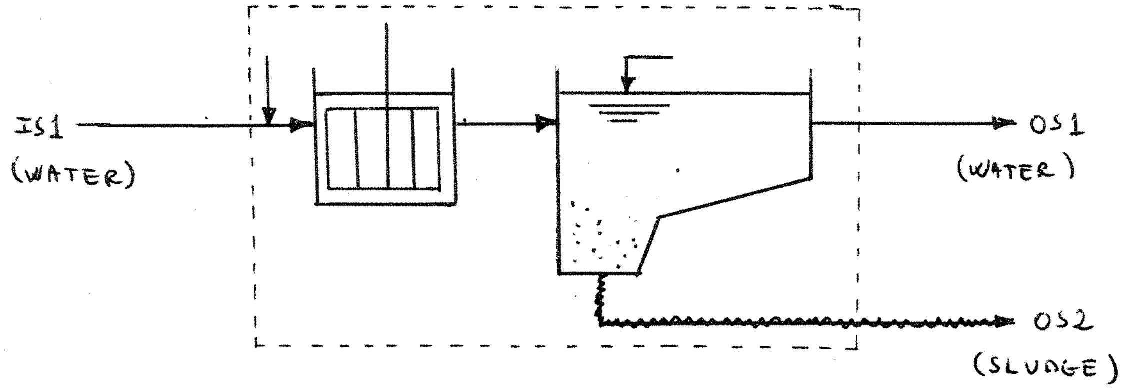
Chemfe

PROCESS NAME: CHEMICAL PRECIPITATION BY $FeCl_3 \cdot 6H_2O$

Process Description

Chemical precipitation by FeCl3*6H2O, including chemical addition, coagulation, flocculation and gravity sedimentation.

Process Sketch



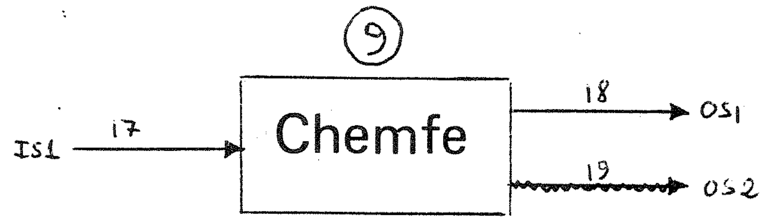
Process Flows

PRINCIPAL INPUT STREAM NUMBER	(IS1) :	WATER INPUT
SECOND INPUT STREAM NUMBER	(IS2) :	——
PRINCIPAL OUTPUT STREAM NUMBER	(OS1) :	WATER OUTPUT
SECOND OUTPUT STREAM NUMBER	(OS2) :	SLUDGE OUTPUT

Process Characteristics

Name	Unit	Option	
* CHEMICAL ADDITION			
PRECIPITATION PH		M1 - A	(1)
DOSE OF FECL3*6H2O	(G/M3)	M1 - B	(2)
RATIO FE/TOT-P	(MOL/MOL)	M1 - C	(3)
* FLOCCULATION			
TEMPERATURE	(DEG C)	M2	(4)
NUMBER OF CHAMBERS		M3	(5)
TOTAL DETENTION TIME AT QDIM	(MIN)	M4	(6)
* SEDIMENTATION BASIN			
OVERFLOW RATE AT QDIM	(M3/M2/H)	M5 - A	(7)
AT QMAXDIM	(M3/M2/H)	M5 - A	(8)
TOTAL AREA	((10**3)*M2)	M5 - B	(9)
DETENTION TIME AT QDIM	(H)	M6 - A	(10)
DEPTH	(M)	M6 - B	(11)
VOLUME	((10**3)*M3)	M6 - C	(12)
SUSPENDED SOLIDS CONCENTRATIONS:			
WATER EFFLUENT (WHEN PREFIXED)	(KG/M3)	M7	(13)
CHEMICAL SLUDGE	[illegible]	M8	(14)

Specification Example




```
==========     P R O C E S S   IDENTIFICATION

     PROCESS NUMBER (N)  : 9
     PROCESS NAME        : CHEMFE

==========     E N D IDENTIFICATION

?                   DO YOU WANT TO SPECIFY PROCESS FLOW? Y

==========     P R O C E S S   FLOW

     PRINCIPAL INPUT STREAM NUMBER   (IS1) : 17
     SECOND INPUT STREAM NUMBER      (IS2) : 0

     PRINCIPAL OUTPUT STREAM NUMBER (OS1) : 18
     SECOND OUTPUT STREAM NUMBER    (OS2) : 19

==========     E N D  FLOW

?                   DO YOU WANT TO GIVE PROCESS CHARACTERISTICS? Y


==========     P R O C E S S   CHARACTERISTICS

     PROCESS NAME:  CHEMFE

* CHEMICAL ADDITION
     PRECIPITATION PH                                        : 5.0

* FLOCCULATION
     TEMPERATURE                          (DEG C)            : 10.
     NUMBER OF CHAMBERS                                      : 3.
     TOTAL DETENTION TIME AT QDIM         (MIN)              : 30.

* SEDIMENTATION BASIN
     OVERFLOW RATE AT QDIM                (M3/M2/H)          : 1.3
                   AT QMAXDIM             (M3/M2/H)          : 2.0
     DETENTION TIME AT QDIM               (H)                :
     DEPTH                                (M)                : 2.5

     SUSPENDED SOLIDS CONCENTRATIONS:
          WATER EFFLUENT (WHEN PREFIXED)  (KG/M3)            : 0.020
          CHEMICAL SLUDGE                 (KG/M3)            : 7.5

==========     E N D  CHARACTERISTICS
```

Process Model

A. ASSUMPTIONS

1. The precipitation products are the inorganic components $FePO_4$ and $Fe(OH)_3$.

2. For the given suspended solids concentration in the output streams, the concentrations of other particulate constituents are calculated proportional to suspended solids.

3. The change in specific gravity in the sludge stream are not accounted for.

4. The dissolved matter concentrations in the water effluent are fixed to a given per centage of influent concentrations.

B. MODEL PRINCIPLES

1. The precipitation process is based on pH and alkalinity, as follows;

    a) Intermediate pH and alkalinity, resulting from FePO4-precipitation.

    b) Final pH and alkalinity after Fe(OH)3-precipitation.

2. Concentration cahnges of dissolved matter are calculated for the following constituents only, for which the fractional removal (normal municipal wastewater assumed) are fixed to;

    P/D = 0.95
    CD/D = 0.95
    HG/D = 0.50
    PB/D = 0.95

3. Particulate matter concentrations are based on mass balances.

4. Special parameters for sludge quality are fixed as follows;

    HYGIENE : 5.
    ODOR : 5.
    PPROT : 7.

Process Identification

PROCESS

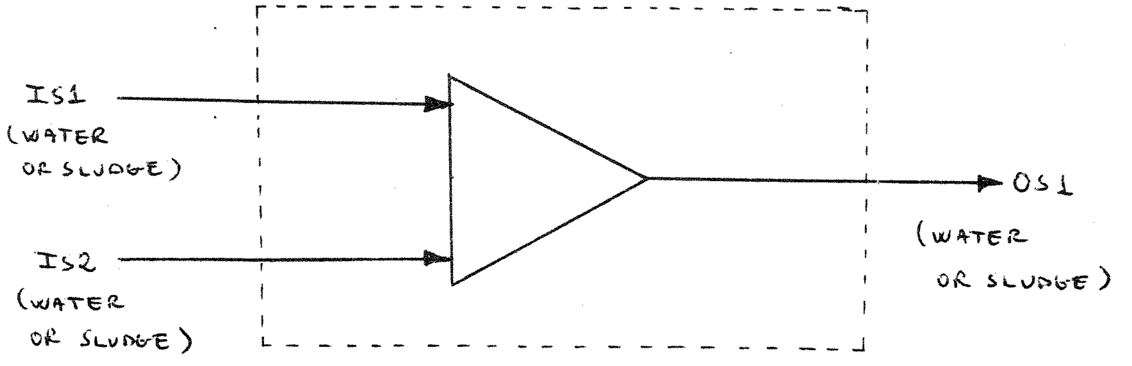
Mix

PROCESS NAME: STREAM MIXER

Process Description

A mixing device, in which two separate streams are mixed into a single output stream.

Process Sketch



Process Flows

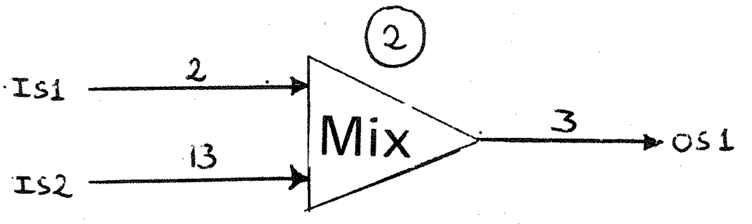
PRINCIPAL INPUT STREAM NUMBER (IS1) : WATER OR SLUDGE INPUT
SECOND INPUT STREAM NUMBER (IS2) : WATER OR SLUDGE INPUT

PRINCIPAL OUTPUT STREAM NUMBER (OS1) : WATER OR SLUDGE OUTPUT
SECOND OUTPUT STREAM NUMBER (OS2) : ———

Process Characteristics

Name	Unit	Option

Specification Example




```
==========      P R O C E S S   IDENTIFICATION

     PROCESS NUMBER (N) : 2
     PROCESS NAME       : MIX

==========      E N D IDENTIFICATION

?                    DO YOU WANT TO SPECIFY PROCESS FLOW? Y

==========      P R O C E S S   FLOW

     PRINCIPAL INPUT STREAM NUMBER   (IS1) : 2
     SECOND INPUT STREAM NUMBER      (IS2) : 13

     PRINCIPAL OUTPUT STREAM NUMBER  (OS1) : 3
     SECOND OUTPUT STREAM NUMBER     (OS2) : 0

==========      E N D  FLOW

?                    DO YOU WANT TO GIVE PROCESS CHARACTERISTICS? Y

==========      P R O C E S S   CHARACTERISTICS

     PROCESS NAME:  MIX

==========      E N D  CHARACTERISTICS
```

Process Model

A. ASSUMPTIONS

1. The mixing process is complete

2. If the input streams have different specific gravity, this is not accounted for in the flow rate calculations.

B. MODEL PRINCIPLES

1. Flow continuity, setting the flow rate of the output stream equal to the sum of the input streams.

2. The concentrations in the output stream are calculated based on a mass balance principle.

3. If sludges with different quality indexes for hygiene, odor and plant protection are mixed, the output indexes are calculated on a mass balance principle, according to 2.

Process Identification

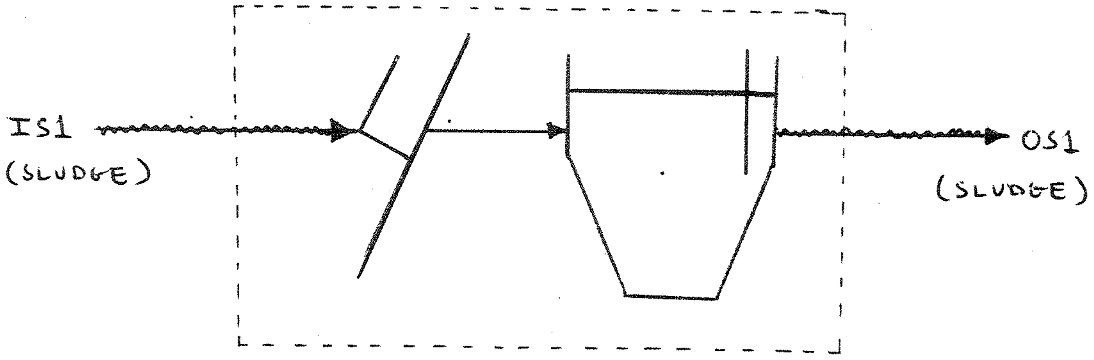
P R O C E S S **Preslu**

PROCESS NAME: PRELIMINARY TREATMENT OF SLUDGE

Process Description

Preliminary sludge treatment processes, including physical unit operations as bar screening and grit removal.

Process Sketch



Process Flows

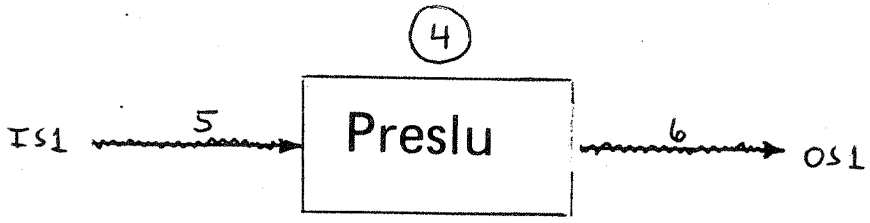
PRINCIPAL INPUT STREAM NUMBER (IS1) : SLUDGE INPUT
SECOND INPUT STREAM NUMBER (IS2) : ______

PRINCIPAL OUTPUT STREAM NUMBER (OS1) : SLUDGE OUTPUT
SECOND OUTPUT STREAM NUMBER (OS2) : ______

Process Characteristics

Name	Unit	Option

Specification Example




```
==========      P R O C E S S   IDENTIFICATION

     PROCESS NUMBER (N)  : 4
     PROCESS NAME        : PRESLU

==========      E N D  IDENTIFICATION

?                    DO YOU WANT TO SPECIFY PROCESS FLOW? Y

==========      P R O C E S S   FLOW

     PRINCIPAL INPUT STREAM NUMBER   (IS1) : 5
     SECOND INPUT STREAM NUMBER      (IS2) : 0

     PRINCIPAL OUTPUT STREAM NUMBER  (OS1) : 6
     SECOND OUTPUT STREAM NUMBER     (OS2) : 0

==========      E N D   FLOW

?                    DO YOU WANT TO GIVE PROCESS CHARACTERISTICS? Y

==========      P R O C E S S   CHARACTERISTICS

     PROCESS NAME:   PRESLU

==========      E N D   CHARACTERISTICS
```

Process Model

A. ASSUMPTIONS

1. No changes in the concentrations of dissolved matter in the processes.

2. No changes in the concentrations of suspended matter.

B. MODEL PRINCIPLE

1. Output = Input

Process Identification

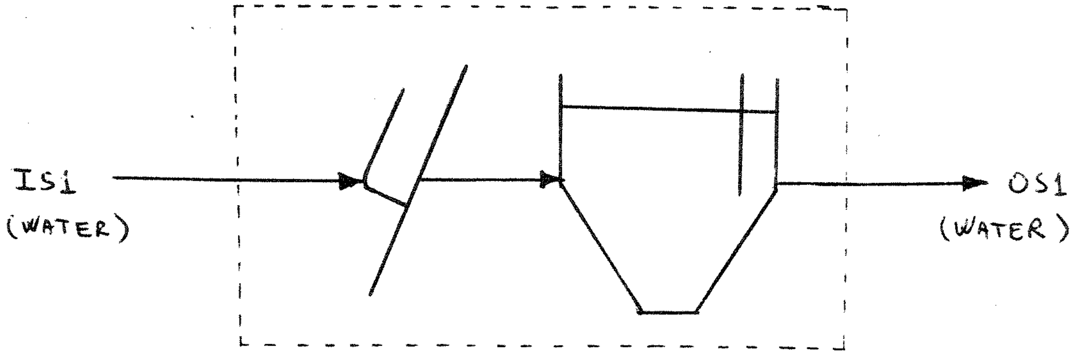
PROCESS **Prewat**

PROCESS NAME: PRELIMINARY TREATMENT OF WATER

Process Description

Preliminary water treatment processes, including physical unit operations as bar screening and grit removal.

Process Sketch



Process Flows

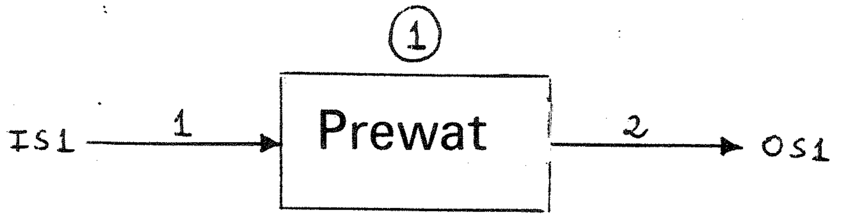
PRINCIPAL INPUT STREAM NUMBER (IS1) : WATER INPUT
SECOND INPUT STREAM NUMBER (IS2) : ———

PRINCIPAL OUTPUT STREAM NUMBER (OS1) : WATER OUTPUT
SECOND OUTPUT STREAM NUMBER (OS2) : ———

Process Characteristics

Name	Unit	Option

Specification Example




```
==========      P R O C E S S   IDENTIFICATION

     PROCESS NUMBER (N)  : 1
     PROCESS NAME        : PREWAT

==========      E N D IDENTIFICATION

?                    DO YOU WANT TO SPECIFY PROCESS FLOW? Y

==========      P R O C E S S   FLOW

     PRINCIPAL INPUT STREAM NUMBER   (IS1) : 1
     SECOND INPUT STREAM NUMBER      (IS2) : 0

     PRINCIPAL OUTPUT STREAM NUMBER (OS1) : 2
     SECOND OUTPUT STREAM NUMBER    (OS2) : 0

==========      E N D   FLOW

?                    DO YOU WANT TO GIVE PROCESS CHARACTERISTICS? Y

==========      P R O C E S S   CHARACTERISTICS

     PROCESS NAME:  PREWAT

==========      E N D   CHARACTERISTICS
```

Process Model

A. ASSUMPTIONS

1. No changes in the concentrations of dissolved matter in the processes.

2. No changes in the concentrations of suspended matter.

B. MODEL PRINCIPLE

1. Output = Input

Process Identification

P R O C E S S

Prised

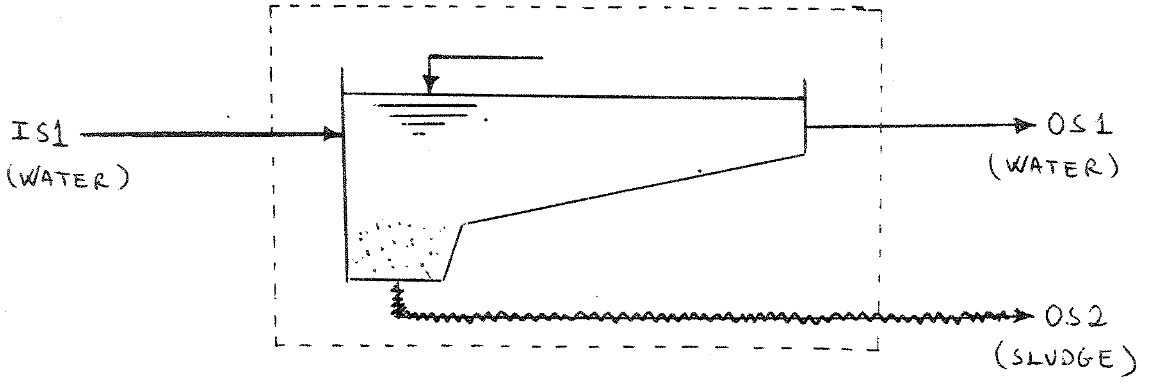
PROCESS NAME: PRIMARY SEDIMENTATION

Process Description

Separation from water, by gravity settling, of suspended particles heavier than water.

The process routine does not include chemical addition. If primary precipitation is used, one of the chemical precipitation routines should be applied.

Process Sketch



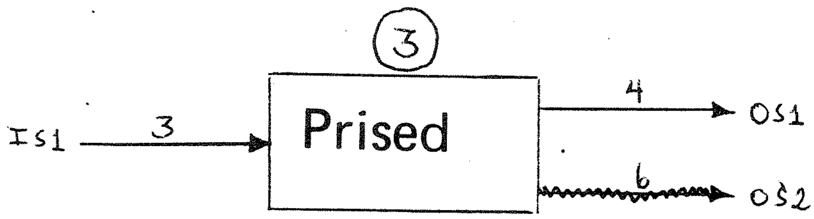
Process Flows

PRINCIPAL INPUT STREAM NUMBER	(IS1) :	WATER INPUT
SECOND INPUT STREAM NUMBER	(IS2) :	———
PRINCIPAL OUTPUT STREAM NUMBER	(OS1) :	WATER OUTPUT
SECOND OUTPUT STREAM NUMBER	(OS2) :	SLUDGE OUTPUT

Process Characteristics

Name	Unit	Option	
* SEDIMENTATION BASIN			
OVERFLOW RATE AT QDIM	(M3/M2/H)	M1 – A	(1)
AT QMAXDIM	(M3/M2/H)	M1 – A	(2)
TOTAL AREA	((10**3)*M2)	M1 – B	(3)
DETENTION TIME AT QDIM	(H)	M2 – A	(4)
DEPTH	(M)	M2 – B	(5)
VOLUME	((10**3)*M3)	M2 – C	(6)
SUSPENDED SOLIDS CONCENTRATIONS:			
WATER EFFLUENT (WHEN PREFIXED)	(KG/M3)	M3	(7)
PRIMARY SLUDGE	(KG/M3)	M4	(8)

Specification Example




```
==========      P R O C E S S   IDENTIFICATION

     PROCESS NUMBER (N)  : 3
     PROCESS NAME        : PRISED

==========      E N D IDENTIFICATION

?                    DO YOU WANT TO SPECIFY PROCESS FLOW? Y

==========      P R O C E S S   FLOW

     PRINCIPAL INPUT STREAM NUMBER   (IS1) : 3
     SECOND INPUT STREAM NUMBER      (IS2) : 0

     PRINCIPAL OUTPUT STREAM NUMBER (OS1) : 4
     SECOND OUTPUT STREAM NUMBER    (OS2) : 6

==========      E N D   FLOW

?                    DO YOU WANT TO GIVE PROCESS CHARACTERISTICS? Y


==========      P R O C E S S   CHARACTERISTICS

     PROCESS NAME:   PRISED

* SEDIMENTATION BASIN
     OVERFLOW RATE AT QDIM                          (M3/M2/H)          : 1.9
                   AT QMAXDIM                       (M3/M2/H)          : 3.8
     DETENTION TIME AT QDIM                         (H)                :
     DEPTH                                          (M)                : 2.5

     SUSPENDED SOLIDS CONCENTRATIONS:
          WATER EFFLUENT (WHEN PREFIXED)            (KG/M3)            : 0.070
          PRIMARY SLUDGE                            (KG/M3)            : 30.0

==========      E N D   CHARACTERISTICS
```

Process Model

A. ASSUMPTIONS

1. No changes in the concentrations of dissolved matter in the process.

2. Particulate matter in the influent is removed proportional to the removal of suspended solids from the water.

3. The change in specific gravity in the sludge is not accounted for.

B. MODEL PRINCIPLES

1. Dissolved matter: Output = Input

2. Particulate matter:

   a) A mass balance on suspended solids, giving the flow rates

   b) The concentrations of the constituents connected to suspended solids are calculated from mass balances, in which the principle of homogeneous mixing is applied.

3. Special parameters for sludge quality are fixed as follows:

```
HYGIENE : 8.
ODOR    : 8.
PPROT   : 8.
```

Process Identification

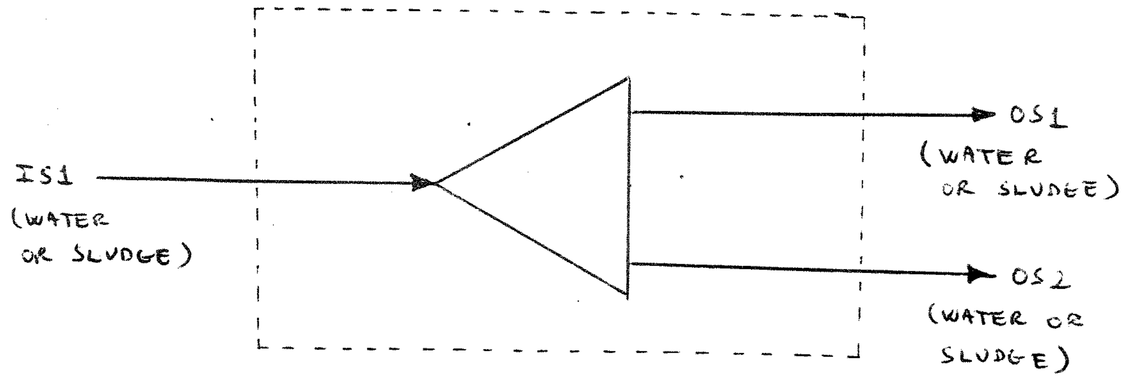
P R O C E S S **Split**

PROCESS NAME: STREAM SPLITTER

Process Description

An overflow device, splitting a single stream into two separate streams.

Process Sketch



Process Flows

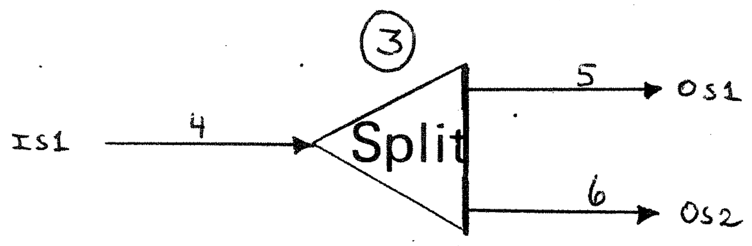
PRINCIPAL INPUT STREAM NUMBER (IS1) : WATER OR SLUDGE INPUT
SECOND INPUT STREAM NUMBER (IS2) : ——

PRINCIPAL OUTPUT STREAM NUMBER (OS1) : WATER OR SLUDGE OUTPUT
SECOND OUTPUT STREAM NUMBER (OS2) : WATER OR SLUDGE OUTPUT

Process Characteristics

Name	Unit	Option
MAXIMUM FLOW OF PRINCIPAL OUTPUT STREAM (OS1)	(M3/H)	M1 (1)

Specification Example




```
==========     P R O C E S S   IDENTIFICATION

     PROCESS NUMBER (N)  : 3
     PROCESS NAME        : SPLIT

==========     E N D  IDENTIFICATION

?                   DO YOU WANT TO SPECIFY PROCESS FLOW? Y

==========     P R O C E S S   FLOW

     PRINCIPAL INPUT STREAM NUMBER    (IS1) : 4
     SECOND INPUT STREAM NUMBER       (IS2) : 0

     PRINCIPAL OUTPUT STREAM NUMBER   (OS1) : 5
     SECOND OUTPUT STREAM NUMBER      (OS2) : 6

==========     E N D   FLOW

?                   DO YOU WANT TO GIVE PROCESS CHARACTERISTICS? Y

==========     P R O C E S S   CHARACTERISTICS

     PROCESS NAME:   SPLIT

     MAXIMUM FLOW OF PRINCIPAL
     OUTPUT STREAM (OS1)                      (M3/H)          : 5.

==========     E N D   CHARACTERISTICS
```

Process Model

A. ASSUMPTIONS

1. The principal output stream has a fixed upper hydraulic capacity limit.

2. Homogenous mixing in the splitter.

B. MODEL PRINCIPLES

1. Flow continuity.
   As long as the capacity of the principal output stream is not exceeded, the flow rate of the principal output stream is equal to the inflow rate.

   When the input stream flow rate exceeds the principal output stream capacity, the difference is set equal to the flow rate of the second output stream.

2. The concentrations in the output streams are equal to the input concentrations.

Process Identification

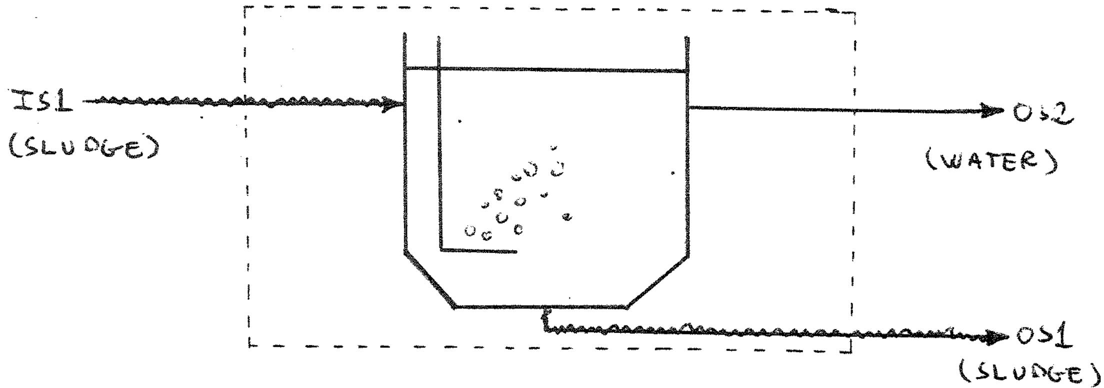
P R O C E S S **Staaer**

PROCESS NAME: AEROBIC STABILIZATION OF SLUDGE

Process Description

Stabilization of sludge under aerobic conditions.

Process Sketch



Process Flows

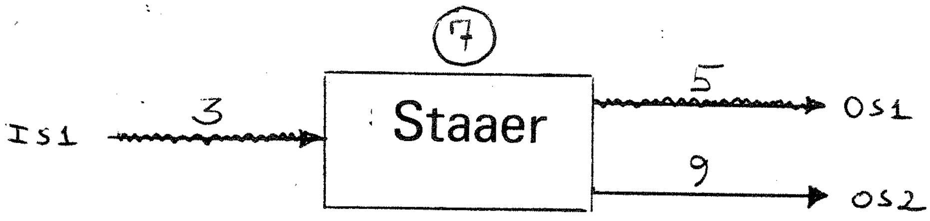
PRINCIPAL INPUT STREAM NUMBER (IS1) : SLUDGE INPUT
SECOND INPUT STREAM NUMBER (IS2) : ———

PRINCIPAL OUTPUT STREAM NUMBER (OS1) : SLUDGE OUTPUT
SECOND OUTPUT STREAM NUMBER (OS2) : WATER OUTPUT

Process Characteristics

Name	Unit	Option
SUSPENDED SOLIDS RETENTION TIME	(DAYS)	M1 (1)
STABILIZATION TEMPERATURE	(DEG C)	M2 (2)
SOLIDS RECOVERY RATIO FOR SLUDGE	(FRACTION)	M3 (3)
SUSPENDED SOLIDS CONCENTRATION OF SLUDGE OUTPUT STREAM	(KG/M**3)	M4 (4)

Specification Example




```
==========     P R O C E S S  IDENTIFICATION

      PROCESS NUMBER (N) : 7
      PROCESS NAME       : STAAER

==========     E N D IDENTIFICATION

?                   DO YOU WANT TO SPECIFY PROCESS FLOW? Y

==========     P R O C E S S  FLOW

      PRINCIPAL INPUT STREAM NUMBER   (IS1) : 3
      SECOND INPUT STREAM NUMBER      (IS2) : 0

      PRINCIPAL OUTPUT STREAM NUMBER  (OS1) : 5
      SECOND OUTPUT STREAM NUMBER     (OS2) : 9

==========     E N D  FLOW

?                   DO YOU WANT TO GIVE PROCESS CHARACTERISTICS? Y

==========     P R O C E S S  CHARACTERISTICS

      PROCESS NAME:  STAAER

      SUSPENDED SOLIDS RETENTION TIME              (DAYS)        : 20.
      STABILIZATION TEMPERATURE                    (DEG C)       : 15.
      SOLIDS RECOVERY RATIO FOR SLUDGE STREAM      (FRACTION)    : 0.99
      SUSPENDED SOLIDS CONSENTRATION
      OF SLUDGE OUTPUT STREAM                     (KG/M3)       : 3.5

==========     E N D  CHARACTERISTICS
```

Process Model

A. ASSUMPTIONS

1. The stabilization process is not used in cases with lime precipitation.

2. Particulate matter concentrations in the output streams are proportional to the suspended solids concentrations.

3. Different specific gravity in the output streams are not accounted for.

B. MODEL PRINCIPLES

1. The biological degradation of organic solid matter is assumed to follow a 1. order reaction;

   $$(VSSt - VSSn)/(VSSo - VSSn) = exp(-Kt*t)$$

   in which

   VSSo = Volatile suspended solids concentration at time zero
   VSSt = Volatile suspended solids concentration at time t
   VSSn = Nonbiodegradable volatile suspended solids concentration, assumed to be 40 per cent of VSSo
   t = detention time (days)
   Kt = rate of decay (per day), assumed to be 0.079*1.10**(T-20.);
   T = temperature (deg C)

2. Soluble organic matter is assumed to follow the same dacay rate as the solid organic matter.

3. Changes in pH and alkalinity are based on "black box"-modelling .

4. Other dissolved constituents are approximated to stay constant.

5. For the special sludge parameters, the following reductions are assumed;

Hygiene	-	40	%
Odor	-	90	%
Pplant	-	10	%

Process Identification

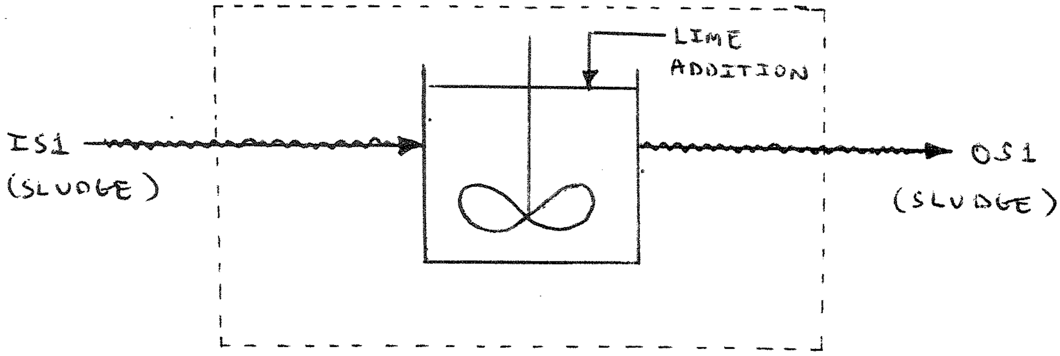
P R O C E S S **Stalim**

PROCESS NAME: LIME STABILIZATION OF SLUDGE

Process Description

A process, in which lime and sludge are mixed to produce a sludge, temporarily stabilized to inhibit biological degradation.

Process Sketch



Process Flows

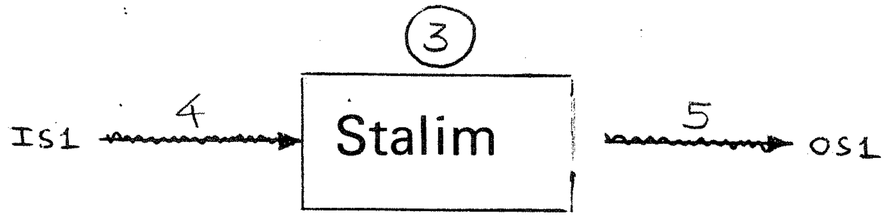
PRINCIPAL INPUT STREAM NUMBER (IS1) : SLUDGE INPUT
SECOND INPUT STREAM NUMBER (IS2) : ______

PRINCIPAL OUTPUT STREAM NUMBER (OS1) : SLUDGE OUTPUT
SECOND OUTPUT STREAM NUMBER (OS2) : ______

Process Characteristics

Name	UNIT	Option
PH AFTER LIME ADDITION	(-)	M1 - (1)
ACTUAL DOSE CA(OH)2	(G/KG SS)	M2 (2)
TEMPERATURE	(DEG C)	M3 (3)
DETENTION TIME MIXING CHAMBER	(MIN)	M4-A (4)
VOLUME OF MIXING CHAMBER	(M**3)	M4-B (5)

Specification Example




```
==========     P R O C E S S   IDENTIFICATION

     PROCESS NUMBER (N)  : 3
     PROCESS NAME        : STALIM

==========     E N D  IDENTIFICATION

?                    DO YOU WANT TO SPECIFY PROCESS FLOW? Y

==========     P R O C E S S   FLOW

     PRINCIPAL INPUT STREAM NUMBER   (IS1) : 4
     SECOND INPUT STREAM NUMBER      (IS2) : 0

     PRINCIPAL OUTPUT STREAM NUMBER  (OS1) : 5
     SECOND OUTPUT STREAM NUMBER     (OS2) : 0

==========     E N D   FLOW

?                    DO YOU WANT TO GIVE PROCESS CHARACTERISTICS? Y

==========     P R O C E S S   CHARACTERISTICS

     PROCESS NAME:   STALIM

     PH AFTER LIME ADDITION                                       : 11.6
     ACTUAL DOSE CA(OH)2                        (G/KG SS)         : 400.
     TEMPERATURE                                (DEG C)           : 13.
     DETENTION TIME FOR MIXING CHAMBER          (MIN.)            : 10.

==========     E N D   CHARACTERISTICS
```

Process Model

A. ASSUMPTIONS

1. The precipitation products are the inorganic components Ca10(PO4)6*(OH)2, Mg(OH)2 and CaCO3.

2. For given suspended solids concentrations in the output streams, the concentrations of other particulate constituents are calculated proportional to suspended solids.

3. The change in specific gravity in the sludge stream is not accounted for.

4. The dissolved matter concentrations in the water effluent are fixed to a given per centage of the influent concentrations.

B. MODEL PRINCIPLES

1. The theoretical necessary dose of Ca(OH)2 to obtain the given precipitation pH are calculated from;

   a) increase in concentration of free OH-ions
   b) displacement of equlibrium in the carbonate system
   c) displacement of equlibrium in the system NH4 - NH3
   d) displacement of equlibrium of phosphates
   e) precipitation of Ca10(PO4)6 * (OH)2
   f) precipitation of Mg(OH)2

2. The precipitation of CaCO3 is based on an equlibrium around the Ca-ion.

3. If the actual dose of Ca(OH)2 exeeds the theoretical dose calculated in B1, the difference is accounted for in the sludge production as unused lime.

4. Concentration changes of dissolved matter are calculated for the following constituents only, for which the fractional removal (normal municipal wastewater assumed) are fixed to;

   P/D = 0.95
   CD/D = 0.95
   HG/D = 0.50
   PB/D = 0.95

5. Particulate matter concentrations are based on mass balances.

6. Special parameters for sludge quality are fixed as follows;

   HYGIENE : 3.
   ODOR : 3.
   PFROT : 5.

Process Identification

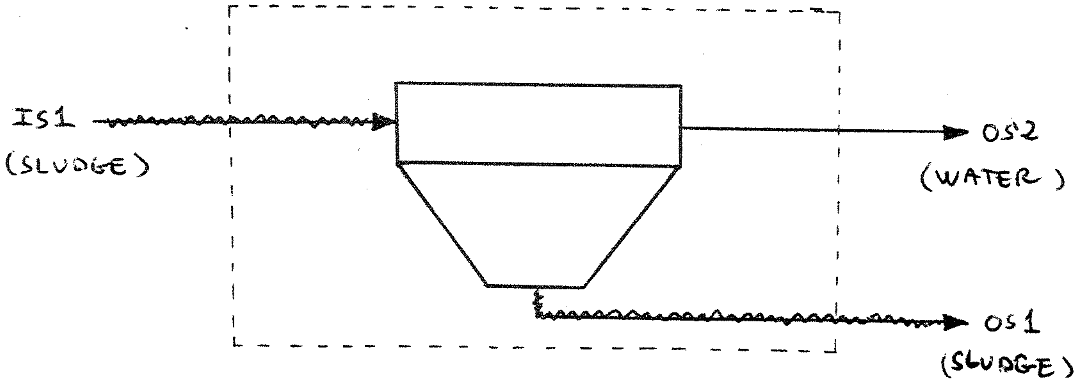
P R O C E S S **Thick**

PROCESS NAME: SLUDGE THICKENING

Process Description

Gravity thickening of sludge, giving a concentrated sludge stream and a water effluent.

Process Sketch



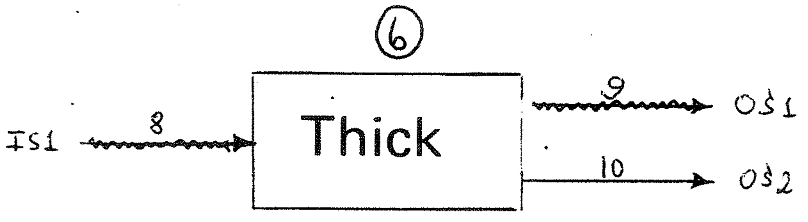
Process Flows

PRINCIPAL INPUT STREAM NUMBER	(IS1) :	SLUDGE INPUT
SECOND INPUT STREAM NUMBER	(IS2) :	———
PRINCIPAL OUTPUT STREAM NUMBER	(OS1) :	SLUDGE OUTPUT
SECOND OUTPUT STREAM NUMBER	(OS2) :	WATER OUTPUT

Process Characteristics

Name	Unit	Option	
SOLIDS RECOVERY RATIO		M1	(1)
SUSPENDED SOLIDS CONCENTRATION OF SLUDGE	(KG/M3)	M2	(2)
DESIGN OVERFLOW RATE	(M3/M2*H)	M3	(3)
DESIGN SOLIDS LOADING RATE	(KG/M3*DAY)	M4	(4)

Specification Example




```
==========     P R O C E S S  IDENTIFICATION

     PROCESS NUMBER (N) : 6
     PROCESS NAME       : THICK

==========     E N D IDENTIFICATION

?                   DO YOU WANT TO SPECIFY PROCESS FLOW? Y

==========     P R O C E S S  FLOW

     PRINCIPAL INPUT STREAM NUMBER   (IS1) : 8
     SECOND INPUT STREAM NUMBER      (IS2) : 0

     PRINCIPAL OUTPUT STREAM NUMBER (OS1) : 9
     SECOND OUTPUT STREAM NUMBER    (OS2) : 10

==========     E N D  FLOW

?                   DO YOU WANT TO GIVE PROCESS CHARACTERISTICS? Y

==========     P R O C E S S  CHARACTERISTICS

     PROCESS NAME:  THICK

     SOLIDS RECOVERY RATIO                                       : 0.95
     SUSPENDED SOLIDS CONCENTRATION OF SLUDGE (KG/M3)            : 50.
     DESIGN OVERFLOW RATE                     (M3/M2*H)          : 0.75
     DESIGN SOLIDS LOADING RATE               (KG/M3*DAY)        : 50.

==========     E N D  CHARACTERISTICS
```

Process Model

A. ASSUMPTIONS

1. No changes in the concentrations of dissolved matter.

2. Particulate matter concentrations in the output streams are proportional to the suspended solids concentrations.

3. Different specific gravity in the output streams are not accounted for.

B. MODEL PRINCIPLES

1. Dissolved matter concentrations: Output=Input

2. Particulate matter:

   a) A mass balance on suspended solids, giving the flow rates for the water effluent and the sludge stream.

   b) The concentrations of the constituents connected to suspended solids are calculated from mass balances, in which the principle of homogeneous mixing are applied.

3. Special parameters for sludge quality in the output sludge stream are set equal to the input values.

4. SYSTEM DESCRIPTION

The system is designed to be flexible and easy to update and change. This goal is reached by using a hierarchical module configuration.
The main system level consists of the modules in Fig. 4.1.

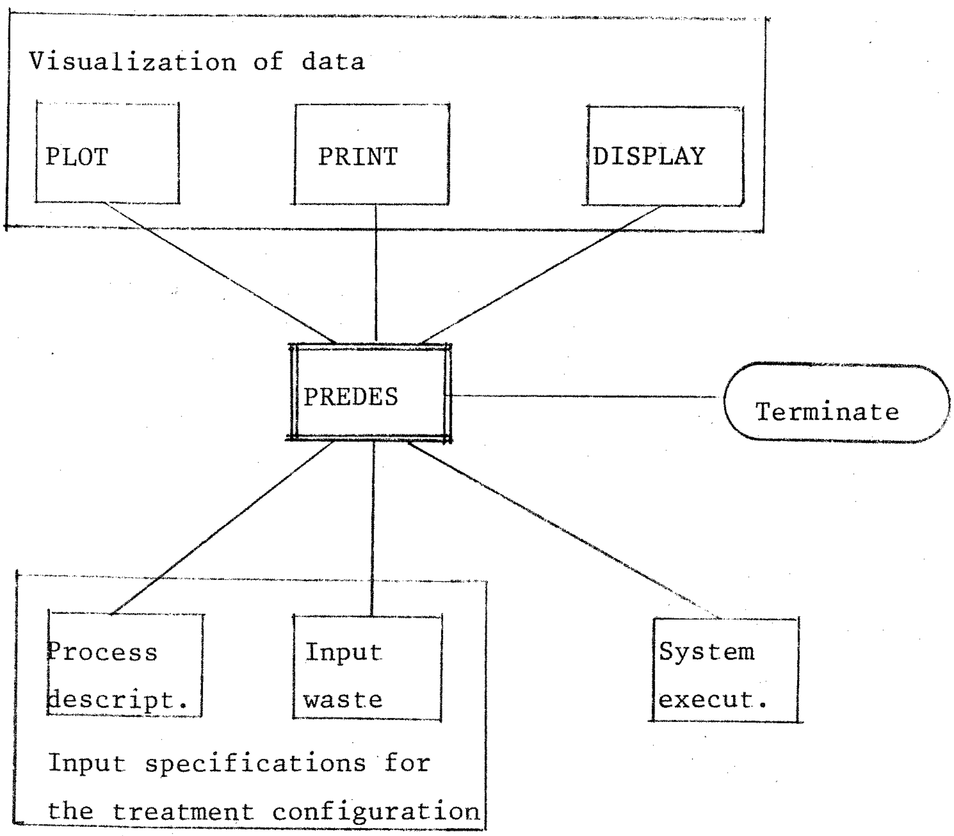


Fig. 4.1. Main modules

When starting the system by typing ÅPREDES, you have to specify a file where to store/retrieve data. If you create a new file, you also have to specify design flows by Qdim and Qmaxdim.
Then you can choose which module to execute by typing a digit corresponding to this module.

The choises look like this;

```
CHOOSE ONE OF THE FOLLOWING OPERATIONS:

                    -3. PLOT
                    -2. PRINT
                    -1. DISPLAY

                     0. TERMINATE

                     1. PROCESS SPECIFICATION
                     2. WASTEWATER SPECIFICATION

                     3. ITERATE
:X
```

Let us look into each of the main modules and see how they function.

4.1 Plot

This module is not implemented yet.

4.2 Print

This module gives a printed documentation of the input values and the results.

The PRINT module is splitted into five other modules, shown in Fig. 4.2. The system has one module for each kind of table to be printed out.

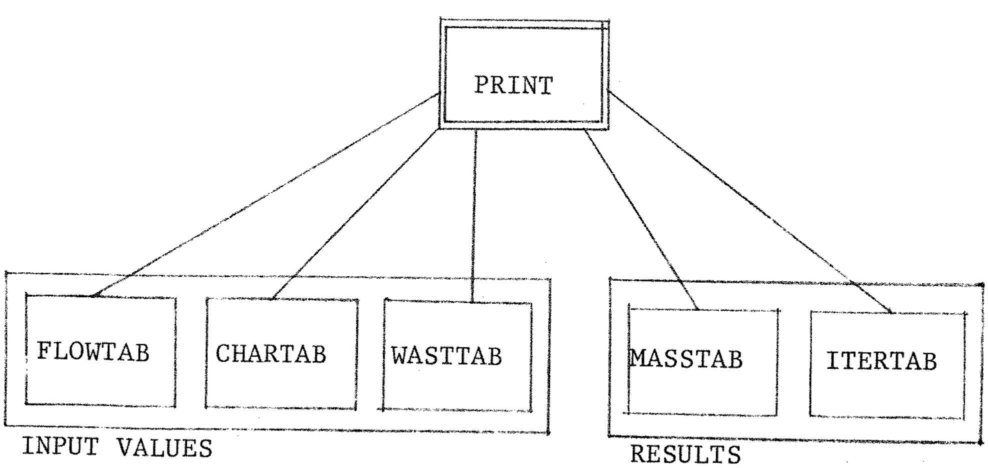


Fig. 4.2 Print modules

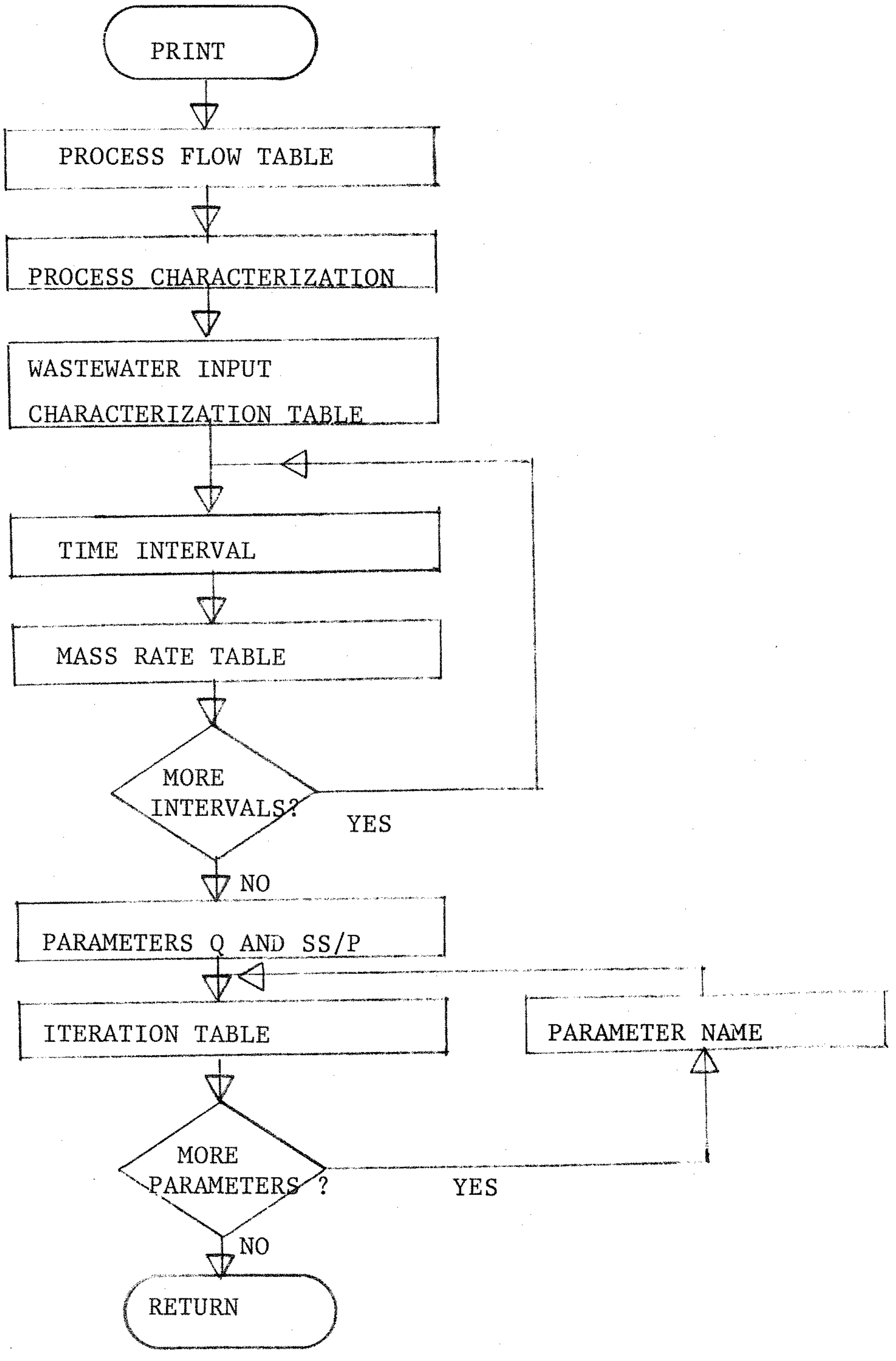
Enterring the PRINT module, you automatically get printouts of the tables concerning the input values.

The tables are;

Process flow table
Process characterization table
Wastewater input characterization table

Concerning the result tables, you have a flexibility. For instance, you can choose time interval (hour, day or year) for the Mass Rate Table, and if you like, you can get tables for all the intervals.

For the iteration table, you automatically get printouts of the tables for the parameters Q and SS/P. If you like, you can choose other /all parameters for the iteration table.



We will give a description of each table.

Process flow table (FLOWTAB)

This table shows which processes the treatment plant consists of, and how the processes are linked together. The tables also contain the design flows by Qdim and Qmaxdim.

QDIM :
QMAXDIM :

Identification		Flow			
N	Process name	IS1	IS2	OS1	OS2

Process characterization table (CHARTAB)

This table shows each process and its corresponding characterization. The process is identified by number and name, and its characterization by a number. The number is explained in section 3 under the corresponding process.

Identification		Characterization			
N	Process name	1	2	......	20

Wastewater input characterization table (WASTTAB)

This table shows the specified values for each parameter. The different parameters are described in section 3.

Stream no.: X

Parameter	Unit	Value

Mass rate table (MASSTAB)

This table shows the mass rates for each parameter and stream. The mass rates are calculated by multiplication of the final iterated stream flows, concentrations and specified time interval.

Time interval: X

Stream number	Parameters				
	SS	VSS	BOF7		MG
X Particulated Dissolved Total					

Iteration table (ITERTAB)

This table shows the parameter values for the three first and the four last iterations for each stream. It also gives the relative differences between the last two iterations.

4.3 Display

By this module you have the opportunity to display data on the terminal, for visualization and control of input data and/or results.

The module is splitted into five other modules, one module for each table to be displayed, see Fig. 4.3.

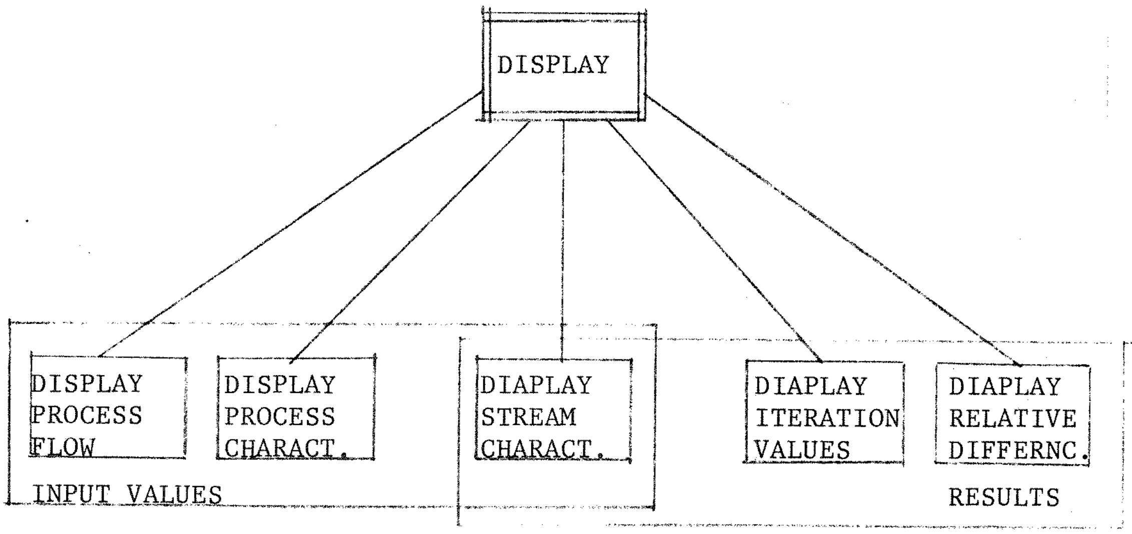


Fig. 4.3 DISPLAY module

Before starting the iterations, you should control the input data. Enterring the DISPLAY module, you can choose which table(s) to display by typing a digit corresponding to the actual table.

The choises are:

```
CHOOSE ONE OF THE FOLLOWING DISPLAY MODES:

                     0. RETURN FROM DISPLAY MODE

                     1. PROCESS FLOW
                     2. PROCESS CHARACTERISTICS
                     3. STREAM CHARACTERISTICS
                     4. ITERATION VALUES
                     5. RELATIVE DIFFERENCES
```

: X_2

A description of each module follows.

Display process flows (DISPPRFL)

By this module you can display which processes the treatment plant consists of, and how they are linked together. Beeing unsatisfied with the flow sheet, you have the possibility to make changes.

P R O C E S S
F L O W

N	PROCESS NAME	IS1	IS2	OS1	OS2

Display process characterization (DISPPRCH)

This module give you the possibility to display the characteristics for specified processes. The process characterization numbers are explained in section 3.

PROCESS NUMBER: X2

P R O C E S S   C H A R A C T E R I Z A T I O N
PROCESS NUMBER: X   Name

CHAR.NUMBER	VALUE

Display stream characterization (DISPSTCH)

Not implemented yet.

Display iteration values (DISPITER)

Not implemented yet.

Display relative differences (DISPDIFF)

This module permits you to display the relative differences for all the actual streams and specified parameters.

4.4 Process description

This module is entered when you specify processes. The PROCESS DESCRIPTION module consists of three other modules, Fig. 4.4.

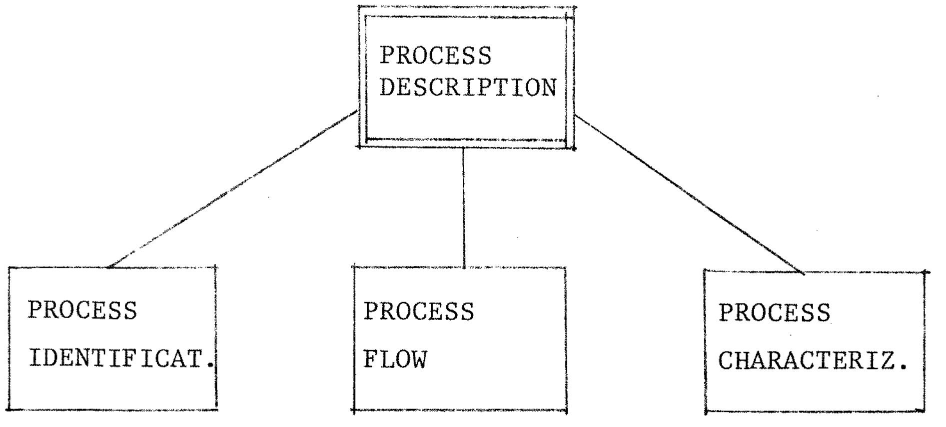


Fig. 4.4 PROCESS DESCRIPTION module

The PROCESS IDENTIFICATION module is used to specify the processes in the plant and to relate the process number to a process name. The legal process names are given in section 3.

```
PROCESS NUMBER : X↵
PROCESS NAME   : X↵
```

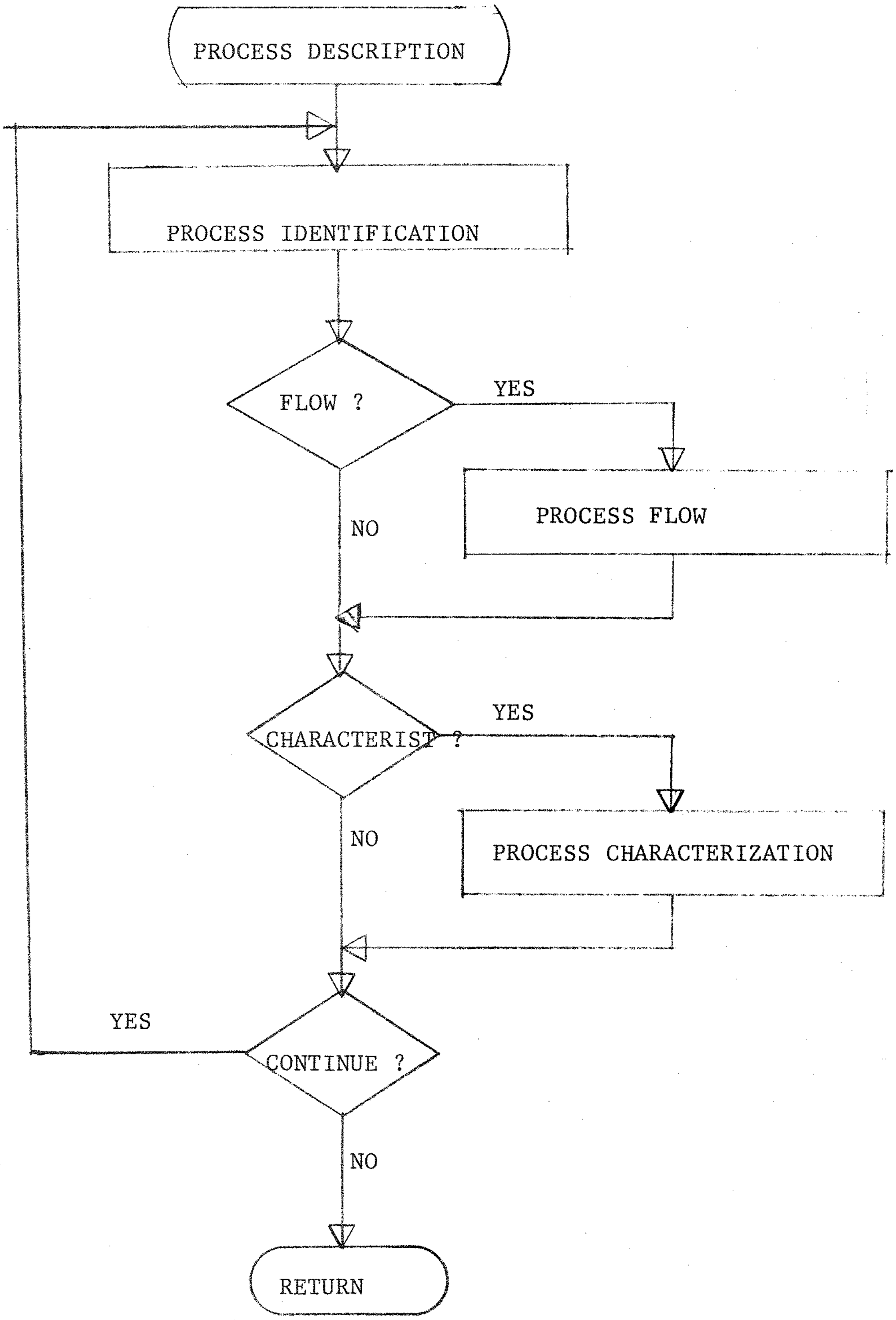
The PROCESS FLOW module is used to assign numbers to the input and output process streams.
Zero value for a stream number indicate no stream.

After identification:

```
PRINCIPAL INPUT STREAM NUMBER (IS1): X↵
SECOND    INPUT STREAM NUMBER (IS2): X↵
PRINCIPAL OUTPUT STREAM NUMBER(OS1): X↵
SECOND    OUTPUT STREAM NUMBER(OS2): X↵
```

The PROCESS CHARACTERIZATION module is used to describe the characteristics of a given process. The characteristics for all implemented processes are described in section 3.

When you enter the PROCESS DESCRIPTION module, the following chart shows what happens:


PROCESS DESCRIPTION
PROCESS IDENTIFICATION
FLOW ?
YES
NO
PROCESS FLOW
CHARACTERIST ?
YES
NO
PROCESS CHARACTERIZATION
YES
CONTINUE ?
NO
RETURN

4.5 Input wastewater characterization

This module is used to specify the input parameter values for a waste stream. The parameters are described in section 2.

If you specify a zero value for the flow rate, the earlier waste characterization of the given stream will be deleted.

4.6 Iteration

This is a time consuming module, so you should check the input values before starting the iterations.

For the given design flows, process descriptions and input waste caharacterizations, the process models are run in at least seven iterations. You can specify the number of iterations you want to run (default value is 7). You can also specify the execution sequence of the processes. The execution sequence will otherwise be of raising order.

If a steady-state sistuation is not reached after the specified number of iterations, you can go on with more iterations until you are pleased.

The process models are all of the steady-state type.

5. COMPLETE EXAMPLE

In this section a practical application of the system is described.

We want to realize the following treatment plant:

1) Plant configuration as shown in Fig. 5.1

2) Design flows:

   Qdim = 70. m3/h
   Qmaxdim =100. m3/h

3) Input wastewater stream no.1 with the following specifications:

Q 70. m3/h

	Particulate	Dissolved	
SS	0.2		kg/m3
VSS	0.15		kg/m3
BOF7	0.15	0.10	kg/m3
P	0.003	0.006	kg/m3
N	0.003	0.014	kg/m3
CD	0.005	0.005	g/m3
HG	0.005	0.005	g/m3
PB	0.003	0.003	g/m3
CA	0.0005	0.020	kg/m3
MG	0.0005	0.005	kg/m3
ALK		2.8	eq/m3
PH		7.2	

Special parameters

HYGIENE	10.
ODOR	10.
PPROT	10.

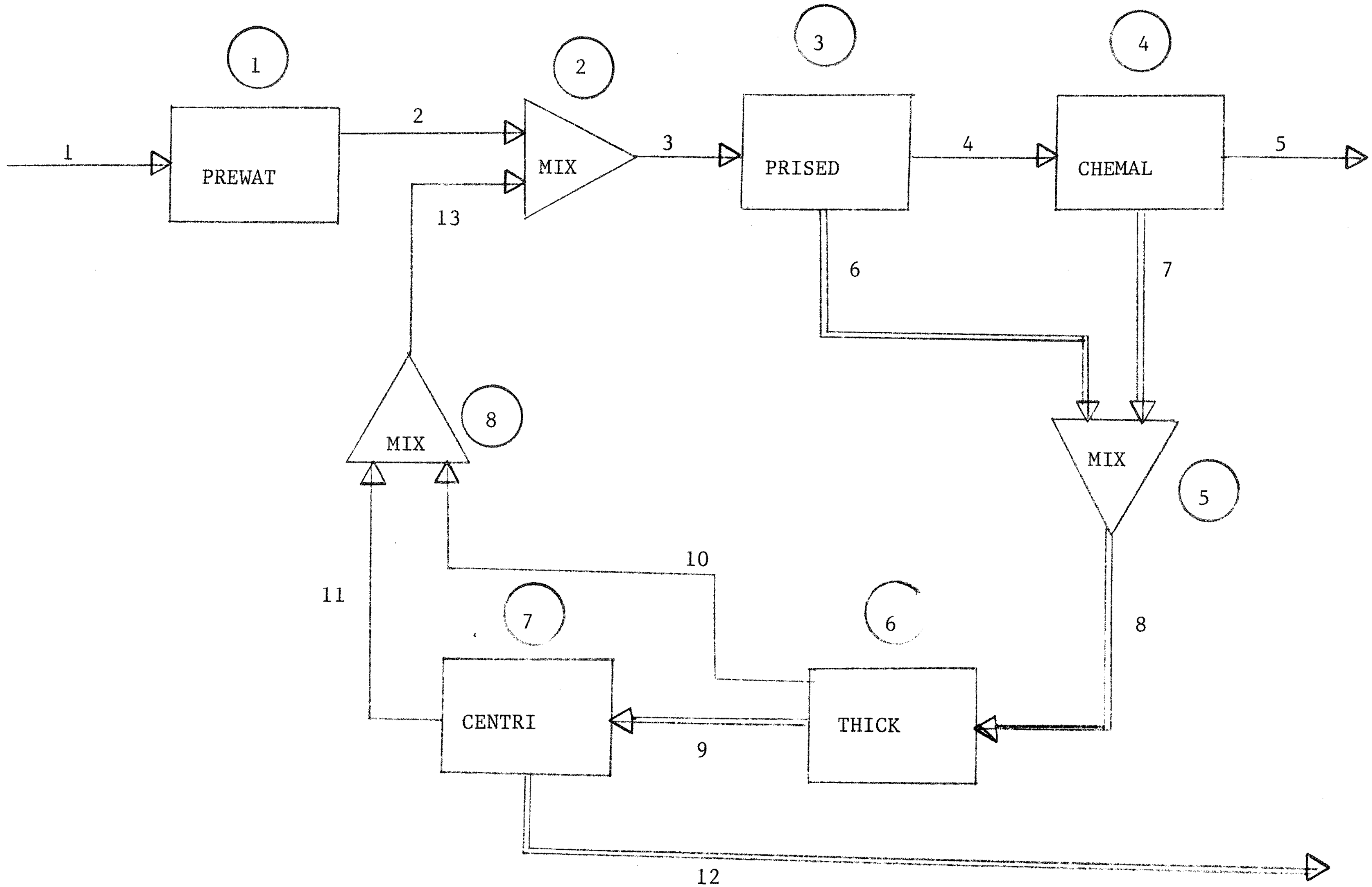
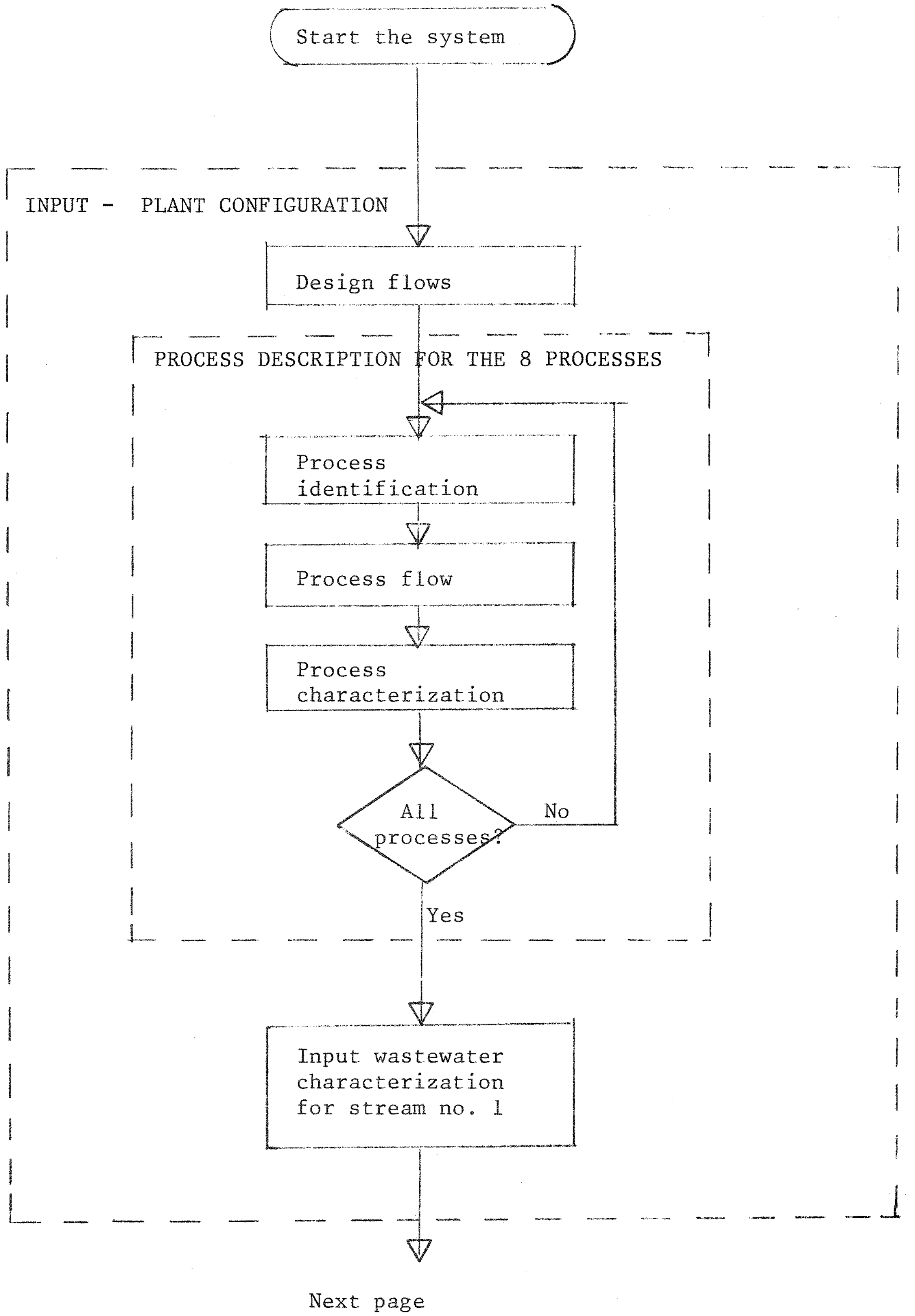
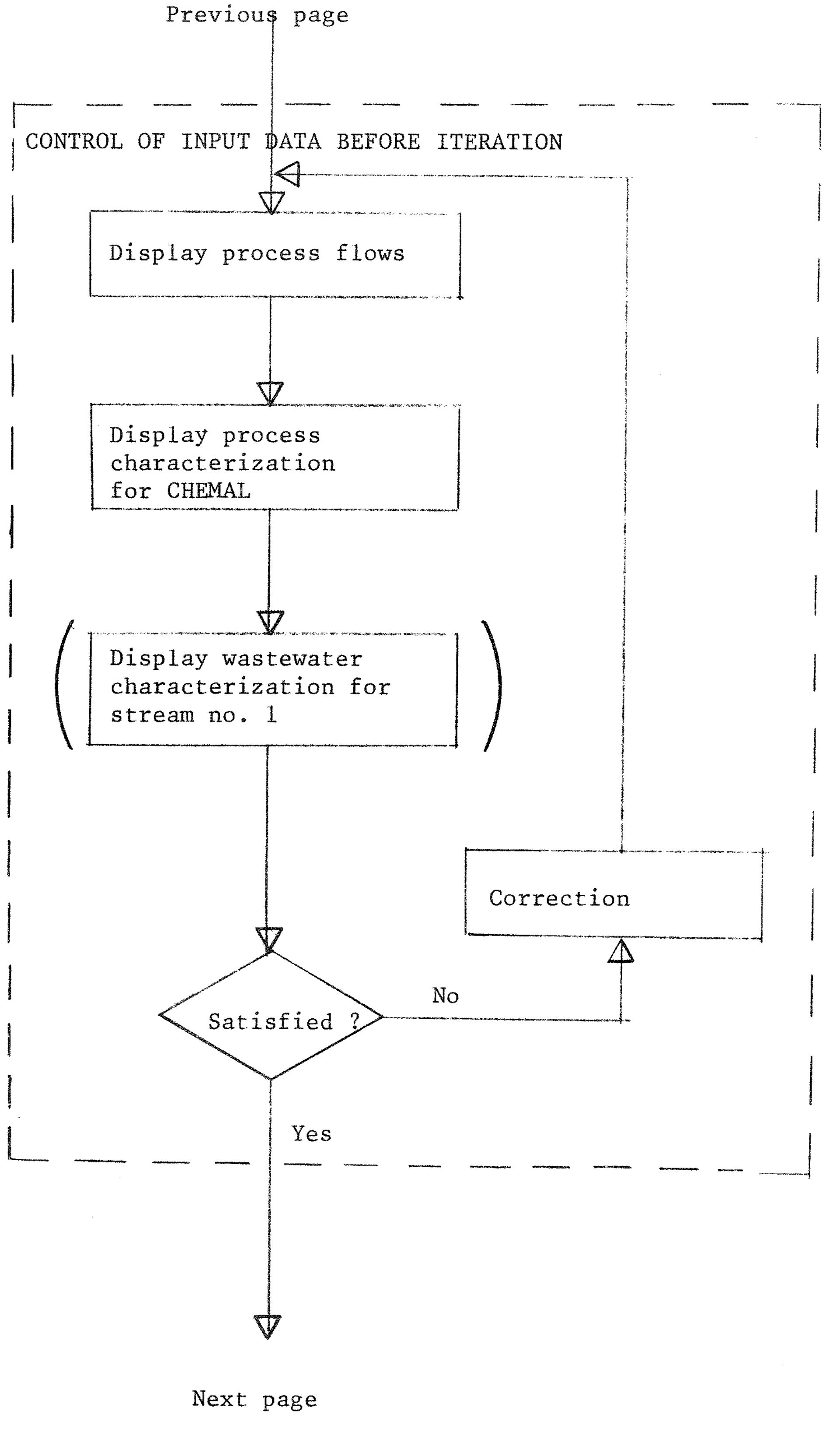
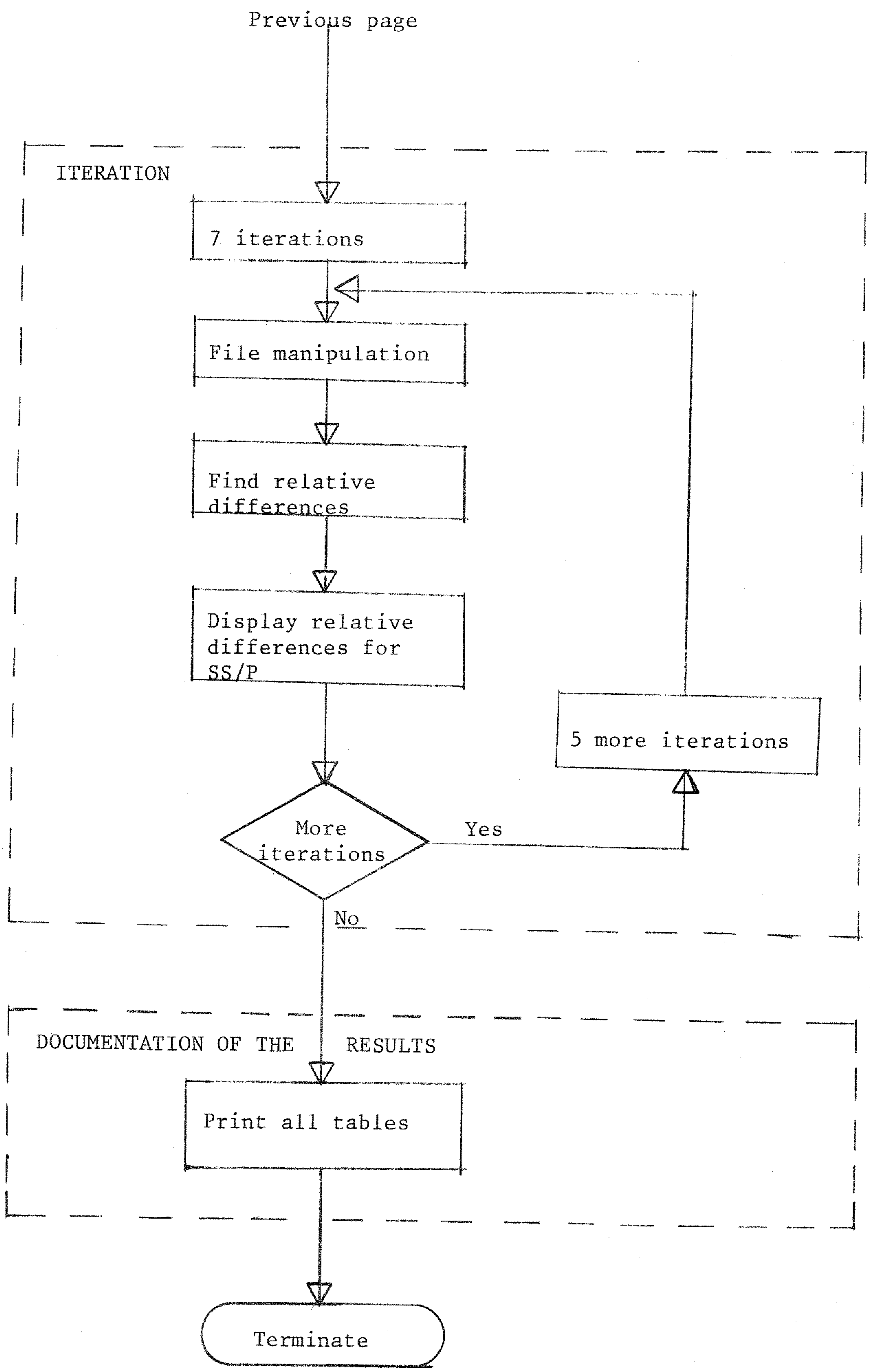


Fig. 5.1. Wastewater treatment plant configuration.

Before we enter PREDES, let us outline what we are going to do.




Previous page
CONTROL OF INPUT DATA BEFORE ITERATION
Display process flows
Display process characterization for CHEMAL
Display wastewater characterization for stream no. 1
Correction
Satisfied ?
No
Yes
Next page


Previous page
ITERATION
7 iterations
File manipulation
Find relative differences
Display relative differences for SS/P
5 more iterations
More iterations
Yes
No
DOCUMENTATION OF THE RESULTS
Print all tables
Terminate

The communication with PREDES should be selfexplaining, so here you are;

```
ÅPREDES

                          W E L C O M E

                               T O
---------------------------------.
                                  :
--------------------------.       :
                          :.....:
                              .
                              .
                              .
                              .
        I                                              I--------------------------
         I
          I                                           I---------------------------
           I                                         I
            I- - - - - - - - - - - - - - - - - - - -I
             I                                     I
              I             N I V A               I
               I                                 I
                I         P R E D E S           I
                 I                             I              1.EDITION
                  I===========================I               1980-01-28

                GIVE NAME ON PROCESS FILE : E5023-EXAMPLE:DATA
?               DO YOU WANT TO CREATE A NEW FILE? Y      NEW FILE
                INITIALIZATION- WAIT!

==========      F L O W  DIMENSIONING

     QDIM                                        (M3/H)           : 70.
     QMAXDIM (>=QDIM)                            (M3/H)           : 100.

==========      E N D  DIMENSIONING


CHOOSE ONE OF THE FOLLOWING OPERATIONS:

                 -3. PLOT
                 -2. PRINT
                 -1. DISPLAY

                  0. TERMINATE

                  1. PROCESS SPECIFICATION
                  2. WASTEWATER SPECIFICATION

                  3. ITERATE
:1
?               DO YOU REALLY WANT TO START PROCESS SPECIFICATIONS? Y
```

```
==========     P R O C E S S  IDENTIFICATION

     PROCESS NUMBER (N) : 1
     PROCESS NAME       : PREWAT

==========     E N D IDENTIFICATION

?                  DO YOU WANT TO SPECIFY PROCESS FLOW? Y

==========     P R O C E S S  FLOW

     PRINCIPAL INPUT STREAM NUMBER  (IS1) : 1
     SECOND INPUT STREAM NUMBER     (IS2) : 0

     PRINCIPAL OUTPUT STREAM NUMBER (OS1) : 2
     SECOND OUTPUT STREAM NUMBER    (OS2) : 0

==========     E N D  FLOW

?                  DO YOU WANT TO GIVE PROCESS CHARACTERISTICS? Y

==========     P R O C E S S  CHARACTERISTICS

     PROCESS NAME:  PREWAT

==========     E N D  CHARACTERISTICS

?                  DO YOU WANT TO CONTINUE WITH PROCESS SPECIFICATIONS? Y
```

```
==========     P R O C E S S   IDENTIFICATION

     PROCESS NUMBER (N)  : 2
     PROCESS NAME        : MIX

==========     E N D  IDENTIFICATION

?                    DO YOU WANT TO SPECIFY PROCESS FLOW? Y

==========     P R O C E S S   FLOW

     PRINCIPAL INPUT STREAM NUMBER   (IS1) : 2
     SECOND INPUT STREAM NUMBER      (IS2) : 13

     PRINCIPAL OUTPUT STREAM NUMBER  (OS1) : 3
     SECOND OUTPUT STREAM NUMBER     (OS2) : 0

==========     E N D   FLOW

?                    DO YOU WANT TO GIVE PROCESS CHARACTERISTICS? Y

==========     P R O C E S S   CHARACTERISTICS

     PROCESS NAME:  MIX

==========     E N D   CHARACTERISTICS

?                    DO YOU WANT TO CONTINUE WITH PROCESS SPECIFICATIONS? Y
```

```
==========     P R O C E S S   IDENTIFICATION

     PROCESS NUMBER (N) : 3
     PROCESS NAME       : PRISED

==========     E N D  IDENTIFICATION

?                   DO YOU WANT TO SPECIFY PROCESS FLOW? Y

==========     P R O C E S S   FLOW

     PRINCIPAL INPUT STREAM NUMBER   (IS1) : 3
     SECOND INPUT STREAM NUMBER      (IS2) : 0

     PRINCIPAL OUTPUT STREAM NUMBER (OS1) : 4
     SECOND OUTPUT STREAM NUMBER    (OS2) : 6

==========     E N D   FLOW

?                   DO YOU WANT TO GIVE PROCESS CHARACTERISTICS? Y

==========     P R O C E S S   CHARACTERISTICS

     PROCESS NAME:  PRISED

* SEDIMENTATION BASIN
     OVERFLOW RATE AT QDIM                     (M3/M2/H)        : 1.9
                   AT QMAXDIM                  (M3/M2/H)        : 3.8
     DETENTION TIME AT QDIM                    (H)              :
     DEPTH                                     (M)              : 2.5

     SUSPENDED SOLIDS CONCENTRATIONS:
          WATER EFFLUENT (WHEN PREFIXED)       (KG/M3)          : 0.070
          PRIMARY SLUDGE                       (KG/M3)          : 30.0

==========     E N D   CHARACTERISTICS

?                   DO YOU WANT TO CONTINUE WITH PROCESS SPECIFICATIONS? Y
```

```
==========     P R O C E S S   IDENTIFICATION

     PROCESS NUMBER (N) : 4
     PROCESS NAME       : CHEMAL

==========     E N D IDENTIFICATION

?                   DO YOU WANT TO SPECIFY PROCESS FLOW? Y

==========     P R O C E S S   FLOW

     PRINCIPAL INPUT STREAM NUMBER  (IS1) : 4
     SECOND INPUT STREAM NUMBER     (IS2) : 0

     PRINCIPAL OUTPUT STREAM NUMBER (OS1) : 5
     SECOND OUTPUT STREAM NUMBER    (OS2) : 7

==========     E N D  FLOW

?                   DO YOU WANT TO GIVE PROCESS CHARACTERISTICS? Y

==========     P R O C E S S   CHARACTERISTICS

     PROCESS NAME:  CHEMAL

* CHEMICAL ADDITION
     PRECIPITATION PH                                          : 5.9

* FLOCCULATION
     TEMPERATURE                            (DEG C)            : 10.
     NUMBER OF CHAMBERS                                        : 3.
     TOTAL DETENTION TIME AT QDIM           (MIN)              : 30.

* SEDIMENTATION BASIN
     OVERFLOW RATE AT QDIM                  (M3/M2/H)          : 1.3
                   AT QMAXDIM               (M3/M2/H)          : 2.0
     DETENTION TIME AT QDIM                 (H)                :
     DEPTH                                  (M)                : 2.5

     SUSPENDED SOLIDS CONCENTRATIONS:
          WATER EFFLUENT (WHEN PREFIXED)    (KG/M3)            : 0.015
          CHEMICAL SLUDGE                   (KG/M3)            : 7.5

==========     E N D  CHARACTERISTICS

?                   DO YOU WANT TO CONTINUE WITH PROCESS SPECIFICATIONS? Y
```

```
==========     P R O C E S S  IDENTIFICATION

     PROCESS NUMBER (N) : 5
     PROCESS NAME       : MIX

==========     E N D IDENTIFICATION

?                    DO YOU WANT TO SPECIFY PROCESS FLOW? Y

==========     P R O C E S S  FLOW

     PRINCIPAL INPUT STREAM NUMBER  (IS1) : 7
     SECOND INPUT STREAM NUMBER     (IS2) : 6

     PRINCIPAL OUTPUT STREAM NUMBER (OS1) : 8
     SECOND OUTPUT STREAM NUMBER    (OS2) : 0

==========     E N D  FLOW

?                    DO YOU WANT TO GIVE PROCESS CHARACTERISTICS? Y

==========     P R O C E S S  CHARACTERISTICS

     PROCESS NAME:  MIX

==========     E N D  CHARACTERISTICS

?                    DO YOU WANT TO CONTINUE WITH PROCESS SPECIFICATIONS? Y
```

```
==========      P R O C E S S  IDENTIFICATION

     PROCESS NUMBER (N) : 6
     PROCESS NAME       : THICK

==========      E N D IDENTIFICATION

?                    DO YOU WANT TO SPECIFY PROCESS FLOW? Y

==========      P R O C E S S  FLOW

     PRINCIPAL INPUT STREAM NUMBER   (IS1) : 8
     SECOND INPUT STREAM NUMBER      (IS2) : 0

     PRINCIPAL OUTPUT STREAM NUMBER  (OS1) : 9
     SECOND OUTPUT STREAM NUMBER     (OS2) : 10

==========      E N D  FLOW

?                    DO YOU WANT TO GIVE PROCESS CHARACTERISTICS? Y

==========      P R O C E S S  CHARACTERISTICS

     PROCESS NAME:  THICK

     SOLIDS RECOVERY RATIO                                          : 0.95
     SUSPENDED SOLIDS CONCENTRATION OF SLUDGE (KG/M3)               : 50.
     DESIGN OVERFLOW RATE                     (M3/M2*H)             : 0.75
     DESIGN SOLIDS LOADING RATE               (KG/M3*DAY)           : 50.

==========      E N D  CHARACTERISTICS

?                    DO YOU WANT TO CONTINUE WITH PROCESS SPECIFICATIONS? Y
```

```
==========     P R O C E S S   IDENTIFICATION

     PROCESS NUMBER (N) : 7
     PROCESS NAME       : CENTRI

==========     E N D  IDENTIFICATION

?              DO YOU WANT TO SPECIFY PROCESS FLOW? Y

==========     P R O C E S S   FLOW

     PRINCIPAL INPUT STREAM NUMBER   (IS1) : 9
     SECOND INPUT STREAM NUMBER      (IS2) : 0

     PRINCIPAL OUTPUT STREAM NUMBER  (OS1) : 12
     SECOND OUTPUT STREAM NUMBER     (OS2) : 11

==========     E N D   FLOW

?              DO YOU WANT TO GIVE PROCESS CHARACTERISTICS? Y

==========     P R O C E S S   CHARACTERISTICS

     PROCESS NAME:  CENTRI

     SOLIDS RECOVERY RATIO FOR CENTRIFUGATION                 : 0.95
     SUSPENDED SOLIDS CONCENTRATION OF SLUDGE
     OUTPUT STREAM                              (KG/M3)       : 200.

==========     E N D   CHARACTERISTICS

?              DO YOU WANT TO CONTINUE WITH PROCESS SPECIFICATIONS? Y
```

```
==========     P R O C E S S   IDENTIFICATION

     PROCESS NUMBER (N) : 8
     PROCESS NAME       : MIX

==========      E N D IDENTIFICATION

?                   DO YOU WANT TO SPECIFY PROCESS FLOW? Y

==========     P R O C E S S   FLOW

     PRINCIPAL INPUT STREAM NUMBER  (IS1) : 10
     SECOND INPUT STREAM NUMBER     (IS2) : 11

     PRINCIPAL OUTPUT STREAM NUMBER (OS1) : 13
     SECOND OUTPUT STREAM NUMBER    (OS2) : 0

==========     E N D   FLOW

?                   DO YOU WANT TO GIVE PROCESS CHARACTERISTICS? Y

==========     P R O C E S S   CHARACTERISTICS

     PROCESS NAME:  MIX

==========     E N D   CHARACTERISTICS

?                   DO YOU WANT TO CONTINUE WITH PROCESS SPECIFICATIONS? N
```

```
CHOOSE ONE OF THE FOLLOWING OPERATIONS:

                          -3. PLOT
                          -2. PRINT
                          -1. DISPLAY

                           0. TERMINATE

                           1. PROCESS SPECIFICATION
                           2. WASTEWATER SPECIFICATION

                           3. ITERATE
:2

==========      W A S T E W A T E R  CHARACTERIZATION

    INPUT STREAM NUMBER: 1

    FLOW RATE (Q)          (M3/H)     : 70.

* PARTICULATE MATTER:
    SS/P                   (KG/M3)    : 0.200
    VSS/P                  (KG/M3)    : 0.150
    BOF7/P                 (KG/M3)    : 0.150
    P/P                    (KG/M3)    : 0.003
    N/P                    (KG/M3)    : 0.003
    CD/P                   (G/M3)     : 0.005
    HG/P                   (G/M3)     : 0.005
    PB/P                   (G/M3)     : 0.003
    CA/P                   (KG/M3)    : 0.0005
    MG/P                   (KG/M3)    : 0.0005

* DISSOLVED MATTER:
    BOF7/D                 (KG/M3)    : 0.100
    P/D                    (KG/M3)    : 0.006
    N/D                    (KG/M3)    : 0.014
    CD/D                   (G/M3)     : 0.005
    HG/D                   (G/M3)     : 0.005
    PB/D                   (G/M3)     : 0.003
    CA/D                   (KG/M3)    : 0.020
    MG/D                   (KG/M3)    : 0.005
    ALK/D                  (MEKV.)    : 2.8
    PH/D                              : 7.2

* SPECIAL PARAMETERS:
    HYGIENE/S              (0-10)     : 10.
    ODOR/S                 (0-10)     : 10.
    PPROT/S                (0-10)     : 10.

?                 DO YOU WANT TO CONTINUE WITH CHARACTERIZATION? N

==========      E N D  CHARACTERIZATION
```

```
CHOOSE ONE OF THE FOLLOWING OPERATIONS:

                    -3. PLOT
                    -2. PRINT
                    -1. DISPLAY

                     0. TERMINATE

                     1. PROCESS SPECIFICATION
                     2. WASTEWATER SPECIFICATION

                     3. ITERATE
:-1

==========     D I S P L A Y  MODE

CHOOSE ONE OF THE FOLLOWING DISPLAY MODES:

                     0. RETURN FROM DISPLAY MODE

                     1. PROCESS FLOW
                     2. PROCESS CHARACTERISTICS
                     3. STREAM CHARACTERISTICS
                     4. ITERATION VALUES
                     5. RELATIVE DIFFERENCES
:1
P R O C E S S
F L O W
```

N	PROCESS NAME	IS1	IS2	OS1	OS2
1	PREWAT	1	0	2	0
2	MIX	2	13	3	0
3	PRISED	3	0	4	6
4	CHEMAL	4	0	5	7
5	MIX	7	6	8	0
6	THICK	8	0	9	10
7	CENTRI	9	0	12	11
8	MIX	10	11	13	0

```
?                ARE YOU SATISFIED WITH THE PROCESS FLOW? Y
```

```
CHOOSE ONE OF THE FOLLOWING DISPLAY MODES:

                    0. RETURN FROM DISPLAY MODE

                    1. PROCESS FLOW
                    2. PROCESS CHARACTERISTICS
                    3. STREAM CHARACTERISTICS
                    4. ITERATION VALUES
                    5. RELATIVE DIFFERENCES
:2

   PROCESS NUMBER: 4

P R O C E S S    C H A R A C T E R I Z A T I O N
PROCESS NUMBER:  4     CHEMAL                 CHAR.NUMBER :    VALUE
                                              ------------------------
                                                   1      :     5.900
                                                   2      :
                                                   3      :
                                                   4      :    10.000
                                                   5      :     3.000
                                                   6      :    30.000
                                                   7      :     1.300
                                                   8      :     2.000
                                                   9      :     0.054
                                                  10      :     1.923
                                                  11      :    -2.500
                                                  12      :     0.135
                                                  13      :     0.015
                                                  14      :     7.500
                                                  15      :
                                                  16      :
                                                  17      :
                                                  18      :
                                                  19      :
                                                  20      :
?                  ARE YOU SATISFIED WITH THE CHARACTERISTIC? Y

?                  DO YOU WANT TO DISPLAY MORE PROCESS CHARACTERISTICS? N


CHOOSE ONE OF THE FOLLOWING DISPLAY MODES:

                    0. RETURN FROM DISPLAY MODE

                    1. PROCESS FLOW
                    2. PROCESS CHARACTERISTICS
                    3. STREAM CHARACTERISTICS
                    4. ITERATION VALUES
                    5. RELATIVE DIFFERENCES
:0

==========       E N D DISPLAY MODE
```

```
CHOOSE ONE OF THE FOLLOWING OPERATIONS:

                    -3. PLOT
                    -2. PRINT
                    -1. DISPLAY

                     0. TERMINATE

                     1. PROCESS SPECIFICATION
                     2. WASTEWATER SPECIFICATION

                     3. ITERATE
:3

?                   DO YOU WANT TO SPECIFY NUMBER OF ITERATIONS (DEFAULT 7)? N

?                   DO YOU WANT TO SPECIFY THE ITERATION SEQUENCE? N

                    ITERATION - WAIT!

                    ITERATION NUMBER:  1
                    ITERATION NUMBER:  2
                          PROCESS EXECUTED:  1
                          PROCESS EXECUTED:  2
                          PROCESS EXECUTED:  3
                          PROCESS EXECUTED:  4
                          PROCESS EXECUTED:  5
                          PROCESS EXECUTED:  6
                          PROCESS EXECUTED:  7
                          PROCESS EXECUTED:  8
                    ITERATION NUMBER:  3
                          PROCESS EXECUTED:  1
                          PROCESS EXECUTED:  2
                          PROCESS EXECUTED:  3
                          PROCESS EXECUTED:  4
                          PROCESS EXECUTED:  5
                          PROCESS EXECUTED:  6
                          PROCESS EXECUTED:  7
                          PROCESS EXECUTED:  8
                    ITERATION NUMBER:  4
                          PROCESS EXECUTED:  1
                          PROCESS EXECUTED:  2
                          PROCESS EXECUTED:  3
                          PROCESS EXECUTED:  4
                          PROCESS EXECUTED:  5
                          PROCESS EXECUTED:  6
                          PROCESS EXECUTED:  7
                          PROCESS EXECUTED:  8
                    ITERATION NUMBER:  5
                          PROCESS EXECUTED:  1
                          PROCESS EXECUTED:  2
                          PROCESS EXECUTED:  3
                          PROCESS EXECUTED:  4
                          PROCESS EXECUTED:  5
                          PROCESS EXECUTED:  6
                          PROCESS EXECUTED:  7
                          PROCESS EXECUTED:  8
                    ITERATION NUMBER:  6
                          PROCESS EXECUTED:  1
                          PROCESS EXECUTED:  2
                          PROCESS EXECUTED:  3
                          PROCESS EXECUTED:  4
                          PROCESS EXECUTED:  5
                          PROCESS EXECUTED:  6
                          PROCESS EXECUTED:  7
                          PROCESS EXECUTED:  8
```

```
ITERATION NUMBER:  7
          PROCESS EXECUTED:  1
          PROCESS EXECUTED:  2
          PROCESS EXECUTED:  3
          PROCESS EXECUTED:  4
          PROCESS EXECUTED:  5
          PROCESS EXECUTED:  6
          PROCESS EXECUTED:  7
          PROCESS EXECUTED:  8

FILE MANIPULATIONS - WAIT!

FIND RELATIVE DIFFERENCES - WAIT!

RELATIVE DIFFERENCE(%) FOR PARAMETER: SS/P

STREAM NO.:  1    0.00   STREAM NO.:  2    0.00
STREAM NO.:  3    0.00   STREAM NO.:  4    0.00
STREAM NO.:  5    0.00   STREAM NO.:  6    0.00
STREAM NO.:  7    0.00   STREAM NO.:  8    0.00
STREAM NO.:  9    0.00   STREAM NO.: 10    0.00
STREAM NO.: 11    0.00   STREAM NO.: 12    0.00
STREAM NO.: 13    0.00

?              DO YOU WANT TO CONTINUE WITH 5 MORE ITERATIONS? N
```

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CHOOSE ONE OF THE FOLLOWING OPERATIONS:

                         -3. PLOT
                         -2. PRINT
                         -1. DISPLAY

                          0. TERMINATE

                          1. PROCESS SPECIFICATION
                          2. WASTEWATER SPECIFICATION

                          3. ITERATE
:-2

                         PRINT ON LP- WAIT!
                                 PROCESS FLOW TABLE
                                 PROCESS CHARACTERIZATION TABLE
                                 WASTEWATER TABLE
                                 MASS RATE TABLE

                                         CHOOSE TIME INTERVAL
                                               1. HOUR
                                               2. DAY
                                               3. YEAR
                                         :1
?                        DO YOU WANT TO GIVE A NEW TIME INTERVAL? Y

                                         CHOOSE TIME INTERVAL
                                               1. HOUR
                                               2. DAY
                                               3. YEAR
                                         :2
?                        DO YOU WANT TO GIVE A NEW TIME INTERVAL? Y

                                         CHOOSE TIME INTERVAL
                                               1. HOUR
                                               2. DAY
                                               3. YEAR
                                         :3
?                        DO YOU WANT TO GIVE A NEW TIME INTERVAL? N
```

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                        ITERATION TABLE
                                     Q
                                     SS/P
?          DO YOU WANT TO PRINT ITERATION-TABLE FOR MORE PARAMETERS? Y

   PARAMETER NAME: ALL

                                     VSS/P
                                     BOF7/P
                                     P/P
                                     N/P
                                     CD/P
                                     HG/P
                                     PB/P
                                     CA/P
                                     MG/P
                                     BOF7/D
                                     P/D
                                     N/D
                                     CD/D
                                     HG/D
                                     PB/D
                                     CA/D
                                     MG/D
                                     ALK/D
                                     PH/D
                                     HYGIENE/S
                                     ODOR/S
                                     PPROT/S
?          DO YOU WANT TO PRINT ITERATION-TABLE FOR MORE PARAMETERS? N
```

```
CHOOSE ONE OF THE FOLLOWING OPERATIONS:

                         -3. PLOT
                         -2. PRINT
                         -1. DISPLAY

                          0. TERMINATE

                          1. PROCESS SPECIFICATION
                          2. WASTEWATER SPECIFICATION

                          3. ITERATE
:0

                         WRITE DATA TO FILE- WAIT!
                                     *
                                    * *
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                                *         *
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                      *.                           .*
                       *.      G O O D B Y E      .*
                         *.                     .*
                            *.               .*
                                *.   *   .*
                                                      NIVA - PREDES
                                                      1.EDITION

@
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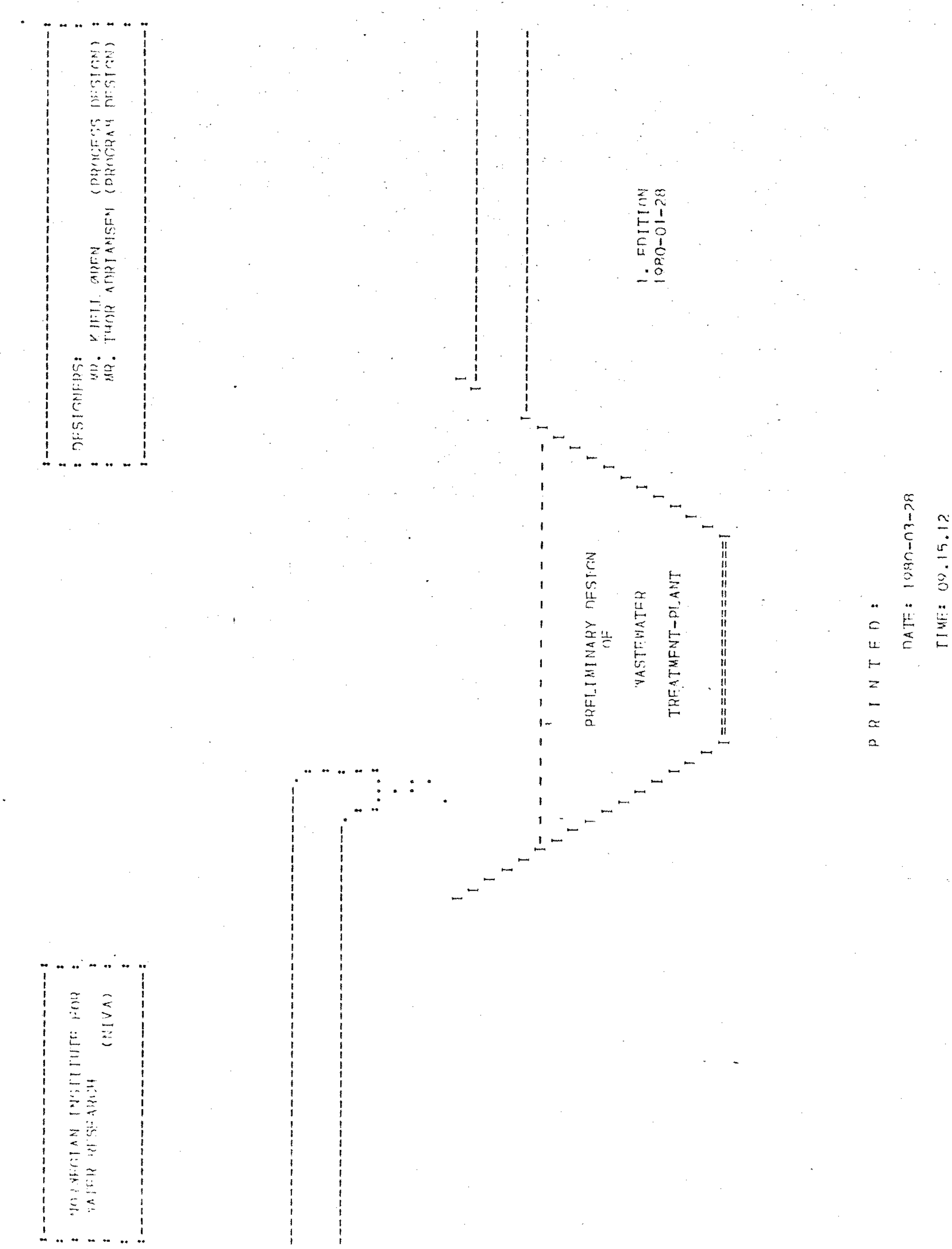
OUTPUT TO THE LINEPRINTER



PROCESS FLOW TABLE

QDIM (M3/H) : 7.000E+01
QMAXDIM (M3/H) : 1.000E+02

IDENTIFICATION		FLOW			
N	PROCESS NAME	IS1	IS2	OS1	OS2
1	PREWAT	1	0	2	0
2	MIX	2	13	3	0
3	PRISED	3	0	4	6
4	CHEMAL	4	0	5	7
5	MIX	7	6	8	0
6	THICK	8	0	9	10
7	CENTRI	9	0	12	11
8	MIX	10	11	13	0
N	PROCESS NAME	IS1	IS2	OS1	OS2

*) LACK OF PROCESS CHARACTERIZATION

NIVA - PREDES DATE: 1980-03-28 TIME: 09.15.12 PAGE: 1

PROCESS CHARACTERIZATION TABLE

IDENTIFICATION		CHARACTERIZATION									
N	PROCESS NAME	1	2	3	4	5	6	7	8	9	10
1	PREWAT	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	MIX	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	PRISED	1.900	3.800	0.037	1.316	2.500	0.092	0.070	30.000	0.000	0.000
4	CHEMAL	5.900	259.332	3.402	10.000	3.000	30.000	1.300	2.000	0.054	1.923
5	MIX	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	THICK	0.950	50.000	0.750	50.000	0.000	0.000	0.000	0.000	0.000	0.000
7	CENTRI	0.950	200.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8	MIX	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N	PROCESS NAME	1	2	3	4	5	6	7	8	9	10

NIVA - PREDES DATE: 1980-03-28 TIME: 09.15.12 PAGE: 2

PROCESS CHARACTERIZATION TABLE

IDENTIFICATION		CHARACTERIZATION									
N	PROCESS NAME	11	12	13	14	15	16	17	18	19	20
1	PREWAT	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	MIX	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	PRISED	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	CHEMAL	2.500	0.135	0.015	7.500	0.000	0.000	0.000	0.000	0.000	0.000
5	MIX	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	THICK	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7	CENTRI	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8	MIX	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N	PROCESS NAME	11	12	13	14	15	16	17	18	19	20

NIVA - PREDES   DATE: 1980-03-28   TIME: 09.15.12   PAGE: 3

WASTEWATER INPUT CHARACTERIZATION TABLE

STREAM NUMBER: 1

PARAMETER	UNIT	VALUE
Q	(M3/H)	70.000000
+ PARTICULATE MATTER		
SS/P	(KG/M3)	0.200000
VSS/P	(KG/M3)	0.150000
BOF7/P	(KG/M3)	0.150000
P/P	(KG/M3)	0.003000
N/P	(KG/M3)	0.003000
CD/P	(G/M3)	0.005000
HG/P	(G/M3)	0.005000
PB/P	(G/M3)	0.003000
CA/P	(KG/M3)	0.000500
MG/P	(KG/M3)	0.000500
+ DISSOLVED MATTER		
BOF7/D	(KG/M3)	0.100000
P/D	(KG/M3)	0.006000
N/D	(KG/M3)	0.014000
CD/D	(G/M3)	0.005000
HG/D	(G/M3)	0.005000
PB/D	(G/M3)	0.003000
CA/D	(KG/M3)	0.020000
MG/D	(KG/M3)	0.005000
ALK/D	(MEKV.)	2.800000
PH/D		7.200000
+ SPECIAL PARAMETERS		
HYGIENE/S	(0-10)	10.000000
ODOR/S	(0-10)	10.000000
PPROT/S	(0-10)	10.000000
PARAMETER	UNIT	VALUE

MASS RATE TABLE
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TIME INTERVAL: HOUR

STREAM NUMBER		SS (KG/H)	VSS (KG/H)	BOF7 (KG/H)	P (KG/H)	N (KG/H)	CD (G/H)	HG (G/H)	PB (G/H)	CA (KG/H)	MG (KG/H)
1	P	14.000	10.500	10.500	0.210	0.210	0.350	0.350	0.210	0.035	0.035
	D			7.000	0.420	0.980	0.350	0.350	0.210	1.400	0.350
	T			17.500	0.630	1.190	0.700	0.700	0.420	1.435	0.385
2	P	14.000	10.500	10.500	0.210	0.210	0.350	0.350	0.210	0.035	0.035
	D			7.000	0.420	0.980	0.350	0.350	0.210	1.400	0.350
	T			17.500	0.630	1.190	0.700	0.700	0.420	1.435	0.385
3	P	15.930	11.593	11.593	0.270	0.232	0.418	0.403	0.251	0.039	0.039
	D			7.145	0.422	1.000	0.352	0.354	0.211	1.429	0.357
	T			18.738	0.693	1.232	0.770	0.758	0.462	1.468	0.396
4	P	4.976	3.621	3.621	0.084	0.072	0.131	0.126	0.078	0.012	0.012
	D			7.109	0.420	0.995	0.350	0.353	0.210	1.422	0.355
	T			10.730	0.505	1.068	0.481	0.479	0.289	1.434	0.368
5	P	1.049	0.384	0.384	0.051	0.008	0.049	0.032	0.029	0.001	0.001
	D			6.991	0.021	0.979	0.017	0.173	0.010	1.398	0.350
	T			7.375	0.072	0.986	0.066	0.205	0.040	1.399	0.351
6	P	10.954	7.971	7.971	0.186	0.159	0.288	0.277	0.173	0.027	0.027
	D			0.037	0.002	0.005	0.002	0.002	0.001	0.007	0.002
	T			8.008	0.188	0.165	0.290	0.279	0.174	0.034	0.028
7	P	8.843	3.237	3.237	0.432	0.065	0.414	0.270	0.249	0.011	0.011
	D			0.118	0.000	0.017	0.000	0.003	0.000	0.024	0.006
	T			3.355	0.433	0.081	0.415	0.273	0.249	0.034	0.017
8	P	19.797	11.209	11.209	0.618	0.224	0.702	0.548	0.421	0.037	0.037
	D			0.154	0.003	0.022	0.002	0.005	0.001	0.031	0.008
	T			11.363	0.621	0.246	0.704	0.552	0.422	0.068	0.045
9	P	18.807	10.649	10.649	0.587	0.213	0.667	0.520	0.400	0.035	0.035
	D			0.038	0.001	0.005	0.001	0.001	0.000	0.008	0.002
	T			10.686	0.588	0.218	0.667	0.521	0.400	0.043	0.037
10	P	0.990	0.560	0.560	0.031	0.011	0.035	0.027	0.021	0.002	0.002
	D			0.117	0.002	0.016	0.002	0.004	0.001	0.023	0.006
	T			0.677	0.033	0.028	0.037	0.031	0.022	0.025	0.008
STREAM NUMBER		(KG/H) SS	(KG/H) VSS	(KG/H) BOF7	(KG/H) P	(KG/H) N	(G/H) CD	(G/H) HG	(G/H) PB	(KG/H) CA	(KG/H) MG

NIVA - PREDES   DATE: 1980-03-28   TIME: 09.15.12   PAGE: 5

MASS RATE TABLE
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TIME INTERVAL: HOUR

STREAM NUMBER		SS (KG/H)	VSS (KG/H)	BOF7 (KG/H)	P (KG/H)	N (KG/H)	CD (G/H)	HG (G/H)	PB (G/H)	CA (KG/H)	MG (KG/H)
		PARAMETERS									
11	P	0.940	0.532	0.532	0.029	0.011	0.033	0.026	0.020	0.002	0.002
	D			0.029	0.000	0.004	0.000	0.001	0.000	0.006	0.001
	T			0.561	0.030	0.015	0.034	0.027	0.020	0.008	0.003
12	P	17.867	10.116	10.116	0.558	0.202	0.634	0.494	0.380	0.034	0.034
	D			0.009	0.000	0.001	0.000	0.000	0.000	0.002	0.000
	T			10.125	0.558	0.204	0.634	0.495	0.380	0.036	0.034
13	P	1.930	1.093	1.093	0.060	0.022	0.068	0.053	0.041	0.004	0.004
	D			0.145	0.002	0.020	0.002	0.004	0.001	0.029	0.007
	T			1.238	0.063	0.042	0.070	0.058	0.042	0.033	0.011
STREAM NUMBER		(KG/H) SS	(KG/H) VSS	(KG/H) BOF7	(KG/H) P	(KG/H) N	(G/H) CD	(G/H) HG	(G/H) PB	(KG/H) CA	(KG/H) MG

NIVA - PREDES

DATE: 1980-03-28 TIME: 09.15.12 PAGE: 6

MASS RATE TABLE

TIME INTERVAL: DAY

STREAM NUMBER		SS (KG/D)	VSS (KG/D)	BOF7 (KG/D)	P (KG/D)	N (KG/D)	CD (G/D)	HG (G/D)	PB (G/D)	CA (KG/D)	MG (KG/D)
		PARAMETERS									
1	P	336.000	252.000	252.000	5.040	5.040	8.400	8.400	5.040	0.840	0.840
	D			168.000	10.080	23.520	8.400	8.400	5.040	33.600	8.400
	T			420.000	15.120	28.560	16.800	16.800	10.080	34.440	9.240
2	P	336.000	252.000	252.000	5.040	5.040	8.400	8.400	5.040	0.840	0.840
	D			168.000	10.080	23.520	8.400	8.400	5.040	33.600	8.400
	T			420.000	15.120	28.560	16.800	16.800	10.080	34.440	9.240
3	P	382.325	278.229	278.229	6.487	5.565	10.043	9.682	6.026	0.927	0.927
	D			171.492	10.137	24.009	8.447	8.507	5.068	34.298	8.575
	T			449.721	16.623	29.573	18.490	18.189	11.094	35.226	9.502
4	P	119.431	86.913	86.913	2.026	1.738	3.137	3.024	1.882	0.290	0.290
	D			170.615	10.085	23.886	8.404	8.464	5.042	34.123	8.531
	T			257.529	12.111	25.624	11.541	11.488	6.925	34.413	8.820
5	P	25.168	9.214	9.214	1.230	0.184	1.179	0.769	0.707	0.031	0.031
	D			167.786	0.496	23.490	0.413	4.162	0.248	33.557	8.389
	T			176.999	1.726	23.674	1.592	4.931	0.955	33.588	8.420
6	P	262.894	191.316	191.316	4.460	3.826	6.906	6.657	4.143	0.638	0.638
	D			0.876	0.052	0.123	0.043	0.043	0.026	0.175	0.044
	T			192.192	4.512	3.949	6.949	6.701	4.169	0.813	0.682
7	P	212.241	77.699	77.699	10.376	1.554	9.942	6.487	5.965	0.259	0.259
	D			2.830	0.008	0.396	0.007	0.070	0.004	0.566	0.141
	T			80.529	10.385	1.950	9.949	6.557	5.969	0.825	0.400
8	P	475.135	269.015	269.015	14.837	5.380	16.848	13.144	10.109	0.897	0.827
	D			3.706	0.060	0.519	0.050	0.114	0.030	0.741	0.185
	T			272.721	14.897	5.899	16.898	13.258	10.139	1.638	1.082
9	P	451.378	255.564	255.564	14.095	5.111	16.005	12.487	9.603	0.852	0.852
	D			0.903	0.015	0.126	0.012	0.028	0.007	0.181	0.045
	T			256.467	14.110	5.238	16.017	12.515	9.610	1.032	0.897
10	P	23.757	13.451	13.451	0.742	0.269	0.842	0.657	0.505	0.045	0.045
	D			2.803	0.046	0.392	0.038	0.086	0.023	0.561	0.140
	T			16.254	0.787	0.661	0.880	0.743	0.528	0.606	0.185
STREAM NUMBER		(KG/D) SS	(KG/D) VSS	(KG/D) BOF7	(KG/D) P	(KG/D) N	(G/D) CD	(G/D) HG	(G/D) PB	(KG/D) CA	(KG/D) MG

MASS RATE TABLE

TIME INTERVAL: DAY

STREAM NUMBER		SS (KG/D)	VSS (KG/D)	BOF7 (KG/D)	P (KG/D)	N (KG/D)	CD (G/D)	HG (G/D)	PB (G/D)	CA (KG/D)	MG (KG/D)
		PARAMETERS									
11	P	22.569	12.778	12.778	0.705	0.256	0.800	0.624	0.480	0.043	0.043
	D			0.688	0.011	0.096	0.009	0.021	0.006	0.139	0.034
	T			13.467	0.716	0.352	0.810	0.645	0.486	0.180	0.077
12	P	428.810	242.786	242.786	13.390	4.856	15.205	11.863	9.123	0.809	0.809
	D			0.214	0.003	0.030	0.003	0.007	0.002	0.043	0.011
	T			243.000	13.394	4.886	15.208	11.869	9.125	0.852	0.820
13	P	46.326	26.229	26.229	1.447	0.525	1.643	1.282	0.986	0.087	0.087
	D			3.492	0.057	0.489	0.047	0.107	0.028	0.698	0.175
	T			29.721	1.503	1.013	1.690	1.389	1.014	0.786	0.262
STREAM NUMBER		(KG/D) SS	(KG/D) VSS	(KG/D) BOF7	(KG/D) P	(KG/D) N	(G/D) CD	(G/D) HG	(G/D) PB	(KG/D) CA	(KG/D) MG

MASS RATE TABLE
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TIME INTERVAL: YEAR

STREAM NUMBER		SS (TON/Y)	VSS (TON/Y)	BOF7 (TON/Y)	P (TON/Y)	N (TON/Y)	CD (KG/Y)	HG (KG/Y)	PB (KG/Y)	CA (TON/Y)	MG (TON/Y)
					PARAMETERS						
1	P	122.640	91.980	91.980	1.840	1.840	3.066	3.066	1.840	0.307	0.307
	D			61.320	3.679	8.585	3.066	3.066	1.840	12.264	3.066
	T			153.300	5.519	10.424	6.132	6.132	3.679	12.571	3.373
2	P	122.640	91.980	91.980	1.840	1.840	3.066	3.066	1.840	0.307	0.307
	D			61.320	3.679	8.585	3.066	3.066	1.840	12.264	3.066
	T			153.300	5.519	10.424	6.132	6.132	3.679	12.571	3.373
3	P	132.549	101.553	101.553	2.368	2.031	3.666	3.534	2.199	0.339	0.339
	D			62.594	3.700	8.763	3.083	3.105	1.850	12.519	3.130
	T			164.148	6.067	10.794	6.749	6.639	4.049	12.857	3.468
4	P	43.592	31.723	31.723	0.740	0.634	1.145	1.104	0.687	0.106	0.106
	D			62.275	3.681	8.718	3.067	3.089	1.840	12.455	3.114
	T			93.998	4.421	9.353	4.213	4.193	2.528	12.561	3.219
5	P	9.186	3.363	3.363	0.449	0.067	0.430	0.281	0.258	0.011	0.011
	D			61.242	0.181	8.574	0.151	1.519	0.090	12.248	3.062
	T			64.605	0.630	8.641	0.581	1.800	0.349	12.260	3.073
6	P	95.956	69.830	69.830	1.628	1.397	2.521	2.430	1.512	0.233	0.233
	D			0.320	0.019	0.045	0.016	0.016	0.009	0.064	0.016
	T			70.150	1.647	1.441	2.536	2.446	1.522	0.297	0.249
7	P	77.468	28.360	28.360	3.787	0.567	3.629	2.368	2.177	0.095	0.095
	D			1.033	0.003	0.145	0.003	0.026	0.002	0.207	0.052
	T			29.393	3.790	0.712	3.631	2.393	2.179	0.301	0.146
8	P	173.424	98.190	98.190	5.415	1.964	6.149	4.798	3.690	0.327	0.327
	D			1.353	0.022	0.189	0.018	0.041	0.011	0.271	0.068
	T			99.543	5.437	2.153	6.168	4.839	3.701	0.598	0.395
9	P	164.753	93.281	93.281	5.145	1.866	5.842	4.558	3.505	0.311	0.311
	D			0.330	0.005	0.046	0.004	0.010	0.003	0.066	0.016
	T			93.610	5.150	1.912	5.846	4.568	3.508	0.377	0.327
10	P	8.671	4.910	4.910	0.271	0.098	0.307	0.240	0.184	0.016	0.016
	D			1.023	0.017	0.143	0.014	0.031	0.009	0.205	0.051
	T			5.933	0.287	0.241	0.321	0.271	0.193	0.221	0.068
STREAM NUMBER		(TON/Y) SS	(TON/Y) VSS	(TON/Y) BOF7	(TON/Y) P	(TON/Y) N	(KG/Y) CD	(KG/Y) HG	(KG/Y) PB	(TON/Y) CA	(TON/Y) MG

MASS RATE TABLE

TIME INTERVAL: YEAR

STREAM NUMBER		SS (TON/Y)	VSS (TON/Y)	BOF7 (TON/Y)	P (TON/Y)	N (TON/Y)	CD (KG/Y)	HG (KG/Y)	PB (KG/Y)	CA (TON/Y)	MG (TON/Y)
						PARAMETERS					
11	P	8.238	4.664	4.664	0.257	0.093	0.292	0.228	0.175	0.016	0.016
	D			0.251	0.004	0.035	0.003	0.008	0.002	0.050	0.013
	T			4.915	0.261	0.128	0.295	0.236	0.177	0.066	0.028
12	P	156.515	88.617	88.617	4.887	1.772	5.550	4.330	3.330	0.295	0.295
	D			0.078	0.001	0.011	0.001	0.002	0.001	0.016	0.004
	T			88.695	4.889	1.783	5.551	4.332	3.331	0.311	0.299
13	P	15.909	9.574	9.574	0.528	0.191	0.600	0.468	0.360	0.032	0.032
	D			1.275	0.021	0.178	0.017	0.039	0.010	0.255	0.064
	T			10.848	0.549	0.370	0.617	0.507	0.370	0.287	0.096
STREAM NUMBER		(TON/Y) SS	(TON/Y) VSS	(TON/Y) BOF7	(TON/Y) P	(TON/Y) N	(KG/Y) CD	(KG/Y) HG	(KG/Y) PB	(TON/Y) CA	(TON/Y) MG

ITERATION TABLE
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PARAMETER NAME: Q (M3/H)

STREAM NUMBER	ITERATION NUMBER 1	2	3	4	5	6	7	RELATIVE DIFFERENCE (%)
1	70.000	70.000	70.000	70.000	70.000	70.000	70.000	0.00
2	0.000	70.000	70.000	70.000	70.000	70.000	70.000	0.00
3	0.000	70.000	71.398	71.449	71.454	71.455	71.455	0.00
4	0.000	69.696	71.039	71.084	71.089	71.090	71.090	0.00
5	0.000	68.521	69.861	69.905	69.910	69.911	69.911	0.00
6	0.000	0.304	0.352	0.365	0.365	0.365	0.365	0.00
7	0.000	1.175	1.178	1.179	1.179	1.179	1.179	0.00
8	0.000	1.479	1.537	1.544	1.544	1.544	1.544	0.00
9	0.000	0.341	0.373	0.376	0.376	0.376	0.376	0.00
10	0.000	1.138	1.165	1.168	1.168	1.168	1.168	0.00
11	0.000	0.260	0.284	0.287	0.287	0.287	0.287	0.00
12	0.000	0.081	0.089	0.089	0.089	0.089	0.089	0.00
13	0.000	1.398	1.449	1.454	1.455	1.455	1.455	0.00
STREAM NUMBER	1	2	3	4	5	6	7	REALTIVE DIFFERENCE (%)

ITERATION TABLE

PARAMETER NAME: SS/P (KG/M3)

STREAM NUMBER	ITERATION NUMBER 1	2	3	4	5	6	7	RELATIVE DIFFERENCE (%)
1	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.00
2	0.000	0.200	0.200	0.200	0.200	0.200	0.200	0.00
3	0.000	0.200	0.221	0.223	0.223	0.223	0.223	0.00
4	0.000	0.070	0.070	0.070	0.070	0.070	0.070	0.00
5	0.000	0.015	0.015	0.015	0.015	0.015	0.015	0.00
6	0.000	30.000	30.000	30.000	30.000	30.000	30.000	0.00
7	0.000	7.500	7.500	7.500	7.500	7.500	7.500	0.00
8	0.000	12.125	12.757	12.814	12.819	12.820	12.820	0.00
9	0.000	50.000	50.000	50.000	50.000	50.000	50.000	0.00
10	0.000	0.788	0.842	0.847	0.847	0.347	0.847	0.00
11	0.000	3.279	3.279	3.279	3.279	3.279	3.279	0.00
12	0.000	200.000	200.000	200.000	200.000	200.000	200.000	0.00
13	0.000	1.251	1.320	1.326	1.327	1.327	1.327	0.00
STREAM NUMBER	1	2	3	4	5	6	7	REALTIVE DIFFERENCE (%)
	ITERATION NUMBER							

ITERATION TABLE
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PARAMETER NAME: VSS/P (KG/M3)

STREAM NUMBER	ITERATION NUMBER 1	2	3	4	5	6	7	RELATIVE DIFFERENCE (%)
1	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.00
2	0.000	0.150	0.150	0.150	0.150	0.150	0.150	0.00
3	0.000	0.150	0.161	0.162	0.162	0.162	0.162	0.00
4	0.000	0.052	0.051	0.051	0.051	0.051	0.051	0.00
5	0.000	0.006	0.006	0.005	0.005	0.005	0.005	0.00
6	0.000	22.500	21.881	21.837	21.832	21.832	21.832	0.00
7	0.000	2.789	2.752	2.746	2.746	2.746	2.746	0.00
8	0.000	6.841	7.221	7.255	7.258	7.258	7.259	0.00
9	0.000	28.210	28.303	28.309	28.309	28.309	28.309	0.00
10	0.000	0.444	0.477	0.479	0.480	0.480	0.480	0.00
11	0.000	1.850	1.856	1.856	1.856	1.856	1.856	0.00
12	0.000	112.839	113.211	113.236	113.237	113.237	113.237	0.00
13	0.000	0.706	0.747	0.751	0.751	0.751	0.751	0.00
STREAM NUMBER	1	2	3	4	5	6	7	REALTIVE DIFFERENCE (%)
	ITERATION NUMBER							

ITERATION TABLE

PARAMETER NAME: BOF7/P (KG/M3)

STREAM NUMBER	ITERATION NUMBER 1	2	3	4	5	6	7	RELATIVE DIFFERENCE (%)
1	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.00
2	0.000	0.150	0.150	0.150	0.150	0.150	0.150	0.00
3	0.000	0.150	0.161	0.162	0.162	0.162	0.162	0.00
4	0.000	0.052	0.051	0.051	0.051	0.051	0.051	0.00
5	0.000	0.006	0.005	0.005	0.005	0.005	0.005	0.00
6	0.000	22.500	21.881	21.837	21.832	21.832	21.832	0.00
7	0.000	2.789	2.752	2.746	2.746	2.746	2.746	0.00
8	0.000	6.841	7.221	7.255	7.258	7.258	7.259	0.00
9	0.000	28.210	28.303	28.309	28.309	28.309	28.309	0.00
10	0.000	0.444	0.477	0.479	0.480	0.480	0.480	0.00
11	0.000	1.850	1.856	1.856	1.856	1.856	1.856	0.00
12	0.000	112.839	113.211	113.236	113.237	113.237	113.237	0.00
13	0.000	0.706	0.747	0.751	0.751	0.751	0.751	0.00
STREAM NUMBER	1	2	3	4	5	6	7 ITERATION NUMBER	REALTIVE DIFFERENCE (%)

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ITERATION TABLE

PARAMETER NAME: P/P (KG/M3)

STREAM NUMBER	ITERATION NUMBER 1	2	3	4	5	6	7	RELATIVE DIFFERENCE (%)
1	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.00
2	0.000	0.003	0.003	0.003	0.003	0.003	0.003	0.00
3	0.000	0.003	0.004	0.004	0.004	0.004	0.004	0.00
4	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.00
5	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.00
6	0.000	0.450	0.504	0.508	0.509	0.509	0.509	0.00
7	0.000	0.359	0.366	0.367	0.367	0.367	0.367	0.00
8	0.000	0.377	0.398	0.400	0.400	0.400	0.400	0.00
9	0.000	1.556	1.561	1.561	1.561	1.561	1.561	0.00
10	0.000	0.025	0.026	0.026	0.026	0.026	0.026	0.00
11	0.000	0.102	0.102	0.102	0.102	0.102	0.102	0.00
12	0.000	6.224	6.243	6.245	6.245	6.245	6.245	0.00
13	0.000	0.039	0.041	0.041	0.041	0.041	0.041	0.00
STREAM NUMBER	1	2	3	4	5	6	7	REALTIVE DIFFERENCE (%)
	ITERATION NUMBER							

ITERATION TABLE

PARAMETER NAME: N/P (KG/M3)

STREAM NUMBER	ITERATION NUMBER 1	2	3	4	5	6	7	RELATIVE DIFFERENCE (%)
1	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.00
2	0.000	0.003	0.003	0.003	0.003	0.003	0.003	0.00
3	0.000	0.003	0.003	0.003	0.003	0.003	0.003	0.00
4	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.00
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
6	0.000	0.450	0.438	0.437	0.437	0.437	0.437	0.00
7	0.000	0.056	0.055	0.055	0.055	0.055	0.055	0.00
8	0.000	0.137	0.144	0.145	0.145	0.145	0.145	0.00
9	0.000	0.564	0.566	0.566	0.566	0.566	0.566	0.00
10	0.000	0.009	0.010	0.010	0.010	0.010	0.010	0.00
11	0.000	0.037	0.037	0.037	0.037	0.037	0.037	0.00
12	0.000	2.257	2.264	2.265	2.265	2.265	2.265	0.00
13	0.000	0.014	0.015	0.015	0.015	0.015	0.015	0.00
STREAM NUMBER	1	2	3	4	5	6	7	REALTIVE DIFFERENCE (%)
	ITERATION NUMBER							

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ITERATION TABLE

PARAMETER NAME: CD/P (G/M3)

STREAM NUMBER	ITERATION NUMBER 1	2	3	4	5	6	7	RELATIVE DIFFERENCE (%)
1	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.00
2	0.000	0.005	0.005	0.005	0.005	0.005	0.005	0.00
3	0.000	0.005	0.006	0.006	0.006	0.006	0.006	0.00
4	0.000	0.002	0.002	0.002	0.002	0.002	0.002	0.00
5	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.00
6	0.000	0.750	0.784	0.788	0.788	0.788	0.788	0.00
7	0.000	0.345	0.351	0.351	0.351	0.351	0.351	0.00
8	0.000	0.428	0.452	0.454	0.455	0.455	0.455	0.00
9	0.000	1.767	1.772	1.773	1.773	1.773	1.773	0.00
10	0.000	0.028	0.030	0.030	0.030	0.030	0.030	0.00
11	0.000	0.116	0.116	0.116	0.116	0.116	0.116	0.00
12	0.000	7.068	7.082	7.091	7.092	7.092	7.092	0.00
13	0.000	0.044	0.047	0.047	0.047	0.047	0.047	0.00
STREAM NUMBER	1	2	3	4	5	6	7	REALTIVE DIFFERENCE (%)
	ITERATION NUMBER							

ITERATION TABLE

PARAMETER NAME: HG/P (G/M3)

STREAM NUMBER	ITERATION NUMBER 1	2	3	4	5	6	7	RELATIVE DIFFERENCE (%)
1	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.00
2	0.000	0.005	0.005	0.005	0.005	0.005	0.005	0.00
3	0.000	0.005	0.006	0.006	0.006	0.006	0.006	0.00
4	0.000	0.002	0.002	0.002	0.002	0.002	0.002	0.00
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
6	0.000	0.750	0.758	0.760	0.760	0.760	0.760	0.00
7	0.000	0.226	0.229	0.229	0.229	0.229	0.229	0.00
8	0.000	0.334	0.353	0.354	0.355	0.355	0.355	0.00
9	0.000	1.375	1.383	1.383	1.383	1.383	1.383	0.00
10	0.000	0.022	0.023	0.023	0.023	0.023	0.023	0.00
11	0.000	0.090	0.091	0.091	0.091	0.091	0.091	0.00
12	0.000	5.502	5.530	5.533	5.533	5.533	5.533	0.00
13	0.000	0.034	0.036	0.037	0.037	0.037	0.037	0.00
STREAM NUMBER	1	2	3	4	5	6	7 ITERATION NUMBER	REALTIVE DIFFERENCE (%)

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ITERATION TABLE

PARAMETER NAME: PB/P (G/M3)

STREAM NUMBER	ITERATION NUMBER 1	2	3	4	5	6	7	RELATIVE DIFFERENCE (%)
1	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.00
2	0.000	0.003	0.003	0.003	0.003	0.003	0.003	0.00
3	0.000	0.003	0.003	0.004	0.004	0.004	0.004	0.00
4	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.00
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
6	0.000	0.450	0.471	0.473	0.473	0.473	0.473	0.00
7	0.000	0.207	0.211	0.211	0.211	0.211	0.211	0.00
8	0.000	0.257	0.271	0.273	0.273	0.273	0.273	0.00
9	0.000	1.060	1.063	1.064	1.064	1.064	1.064	0.00
10	0.000	0.017	0.018	0.018	0.018	0.018	0.018	0.00
11	0.000	0.070	0.070	0.070	0.070	0.070	0.070	0.00
12	0.000	4.241	4.254	4.255	4.255	4.255	4.255	0.00
13	0.000	0.027	0.028	0.028	0.028	0.028	0.028	0.00
STREAM NUMBER	1	2	3	4	5	6	7	REALTIVE DIFFERENCE (%)
	ITERATION NUMBER							

ITERATION TABLE

PARAMETER NAME: CA/P (KG/M3)

STREAM NUMBER	ITERATION NUMBER 1	2	3	4	5	6	7	RELATIVE DIFFERENCE (%)
1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
3	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.00
4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
6	0.000	0.075	0.073	0.073	0.073	0.073	0.073	0.00
7	0.000	0.009	0.009	0.009	0.009	0.009	0.009	0.00
8	0.000	0.023	0.024	0.024	0.024	0.024	0.024	0.00
9	0.000	0.094	0.094	0.094	0.094	0.094	0.094	0.00
10	0.000	0.001	0.002	0.002	0.002	0.002	0.002	0.00
11	0.000	0.006	0.006	0.006	0.006	0.006	0.006	0.00
12	0.000	0.376	0.377	0.377	0.377	0.377	0.377	0.00
13	0.000	0.002	0.002	0.003	0.003	0.003	0.003	0.00
STREAM NUMBER	1	2	3	4	5	6	7	REALTIVE DIFFERENCE (%)
	ITERATION NUMBER							

ITERATION TABLE

PARAMETER NAME: MG/P (KG/M3)

STREAM NUMBER	ITERATION NUMBER 1	2	3	4	5	6	7	RELATIVE DIFFERENCE (%)
1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
3	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.00
4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
6	0.000	0.075	0.073	0.073	0.073	0.073	0.073	0.00
7	0.000	0.009	0.009	0.009	0.009	0.009	0.009	0.00
8	0.000	0.023	0.024	0.024	0.024	0.024	0.024	0.00
9	0.000	0.094	0.094	0.094	0.094	0.094	0.094	0.00
10	0.000	0.001	0.002	0.002	0.002	0.002	0.002	0.00
11	0.000	0.006	0.006	0.006	0.006	0.006	0.006	0.00
12	0.000	0.376	0.377	0.377	0.377	0.377	0.377	0.00
13	0.000	0.002	0.002	0.003	0.003	0.003	0.003	0.00
STREAM NUMBER	1	2	3	4	5	6	7	REALTIVE DIFFERENCE (%)
	ITERATION NUMBER							

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ITERATION TABLE

PARAMETER NAME: ROE7/D (KG/M3)

STREAM NUMBER	ITERATION NUMBER 1	2	3	4	5	6	7	RELATIVE DIFFERENCE (%)
1	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.00
2	0.000	0.100	0.100	0.100	0.100	0.100	0.100	0.00
3	0.000	0.100	0.100	0.100	0.100	0.100	0.100	0.00
4	0.000	0.100	0.100	0.100	0.100	0.100	0.100	0.00
5	0.000	0.100	0.100	0.100	0.100	0.100	0.100	0.00
6	0.000	0.100	0.100	0.100	0.100	0.100	0.100	0.00
7	0.000	0.100	0.100	0.100	0.100	0.100	0.100	0.00
8	0.000	0.100	0.100	0.100	0.100	0.100	0.100	0.00
9	0.000	0.100	0.100	0.100	0.100	0.100	0.100	0.00
10	0.000	0.100	0.100	0.100	0.100	0.100	0.100	0.00
11	0.000	0.100	0.100	0.100	0.100	0.100	0.100	0.00
12	0.000	0.100	0.100	0.100	0.100	0.100	0.100	0.00
13	0.000	0.100	0.100	0.100	0.100	0.100	0.100	0.00
STREAM NUMBER	1	2	3	4	5	6	7	REALTIVE DIFFERENCE (%)
	ITERATION NUMBER							

ITERATION TABLE

PARAMETER NAME: P/D (KG/M3)

STREAM NUMBER	ITERATION NUMBER 1	2	3	4	5	6	7	RELATIVE DIFFERENCE (%)
1	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.00
2	0.000	0.006	0.006	0.006	0.006	0.006	0.006	0.00
3	0.000	0.006	0.006	0.006	0.006	0.006	0.006	0.00
4	0.000	0.006	0.006	0.006	0.006	0.006	0.006	0.00
5	0.000	0.000	0.000	0.000	0.000	0.006	0.006	0.00
6	0.000	0.006	0.006	0.006	0.006	0.000	0.000	0.00
7	0.000	0.000	0.000	0.000	0.000	0.006	0.006	0.00
8	0.000	0.001	0.002	0.002	0.002	0.000	0.000	0.00
9	0.000	0.001	0.002	0.002	0.002	0.002	0.002	0.00
10	0.000	0.001	0.002	0.002	0.002	0.002	0.002	0.00
11	0.000	0.001	0.002	0.002	0.002	0.002	0.002	0.00
12	0.000	0.001	0.002	0.002	0.002	0.002	0.002	0.00
13	0.000	0.001	0.002	0.002	0.002	0.002	0.002	0.00
STREAM NUMBER	1	2	3	4	5	6	7	REALTIVE DIFFERENCE (%)
	ITERATION NUMBER							

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ITERATION TABLE

PARAMETER NAME: N/D (KG/M3)

STREAM NUMBER	ITERATION NUMBER 1	2	3	4	5	6	7	RELATIVE DIFFERENCE (%)
1	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.00
2	0.000	0.014	0.014	0.014	0.014	0.014	0.014	0.00
3	0.000	0.014	0.014	0.014	0.014	0.014	0.014	0.00
4	0.000	0.014	0.014	0.014	0.014	0.014	0.014	0.00
5	0.000	0.014	0.014	0.014	0.014	0.014	0.014	0.00
6	0.000	0.014	0.014	0.014	0.014	0.014	0.014	0.00
7	0.000	0.014	0.014	0.014	0.014	0.014	0.014	0.00
8	0.000	0.014	0.014	0.014	0.014	0.014	0.014	0.00
9	0.000	0.014	0.014	0.014	0.014	0.014	0.014	0.00
10	0.000	0.014	0.014	0.014	0.014	0.014	0.014	0.00
11	0.000	0.014	0.014	0.014	0.014	0.014	0.014	0.00
12	0.000	0.014	0.014	0.014	0.014	0.014	0.014	0.00
13	0.000	0.014	0.014	0.014	0.014	0.014	0.014	0.00
STREAM NUMBER	1	2	3	4	5	6	7	REALTIVE DIFFERENCE (%)
	ITERATION NUMBER							

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ITERATION TABLE
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PARAMETER NAME: COD (G/M3)

STREAM NUMBER	ITERATION NUMBER 1	2	3	4	5	6	7	RELATIVE DIFFERENCE (%)
1	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.00
2	0.000	0.005	0.005	0.005	0.005	0.005	0.005	0.00
3	0.000	0.005	0.005	0.005	0.005	0.005	0.005	0.00
4	0.000	0.005	0.005	0.005	0.005	0.005	0.005	0.00
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
6	0.000	0.005	0.005	0.005	0.005	0.005	0.005	0.00
7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
8	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.00
9	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.00
10	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.00
11	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.00
12	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.00
13	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.00
STREAM NUMBER	1	2	3	4	5	6	7 ITERATION NUMBER	REALTIVE DIFFERENCE (%)

ITERATION TABLE

PARAMETER NAME: HGZD (G/M3)

STREAM NUMBER	ITERATION NUMBER 1	2	3	4	5	6	7	RELATIVE DIFFERENCE (%)
1	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.00
2	0.000	0.005	0.005	0.005	0.005	0.005	0.005	0.00
3	0.000	0.005	0.005	0.005	0.005	0.005	0.005	0.00
4	0.000	0.005	0.005	0.005	0.005	0.005	0.005	0.00
5	0.000	0.003	0.002	0.002	0.002	0.002	0.002	0.00
6	0.000	0.005	0.005	0.005	0.005	0.005	0.005	0.00
7	0.000	0.003	0.002	0.002	0.002	0.002	0.002	0.00
8	0.000	0.003	0.003	0.003	0.003	0.003	0.003	0.00
9	0.000	0.003	0.003	0.003	0.003	0.003	0.003	0.00
10	0.000	0.003	0.003	0.003	0.003	0.003	0.003	0.00
11	0.000	0.003	0.003	0.003	0.003	0.003	0.003	0.00
12	0.000	0.003	0.003	0.003	0.003	0.003	0.003	0.00
13	0.000	0.003	0.003	0.003	0.003	0.003	0.003	0.00
STREAM NUMBER	1	2	3	4	5	6	7 ITERATION NUMBER	REALTIVE DIFFERENCE (%)

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ITERATION TABLE

PARAMETER NAME: PB/D (G/M3)

STRFAM : NUMBER	ITERATION NUMBER 1	2	3	4	5	6	7	RELATIVE DIFFERENCE (%)
1	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.00
2	0.000	0.003	0.003	0.003	0.003	0.003	0.003	0.00
3	0.000	0.003	0.003	0.003	0.003	0.003	0.003	0.00
4	0.000	0.003	0.003	0.003	0.003	0.003	0.003	0.00
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
6	0.000	0.003	0.003	0.003	0.003	0.003	0.003	0.00
7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
8	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.00
9	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.00
10	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.00
11	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.00
12	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.00
13	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.00
STREAM : NUMBER	1	2	3	4	5	6	7 ITERATION NUMBER	REALTIVE DIFFERENCE (%)

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ITERATION TABLE

PARAMETER NAME: CA/D (KG/M3)

STREAM NUMBER	ITERATION NUMBER 1	2	3	4	5	6	7	RELATIVE DIFFERENCE (%)
1	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.00
2	0.000	0.020	0.020	0.020	0.020	0.020	0.020	0.00
3	0.000	0.020	0.020	0.020	0.020	0.020	0.020	0.00
4	0.000	0.020	0.020	0.020	0.020	0.020	0.020	0.00
5	0.000	0.020	0.020	0.020	0.020	0.020	0.020	0.00
6	0.000	0.020	0.020	0.020	0.020	0.020	0.020	0.00
7	0.000	0.020	0.020	0.020	0.020	0.020	0.020	0.00
8	0.000	0.020	0.020	0.020	0.020	0.020	0.020	0.00
9	0.000	0.020	0.020	0.020	0.020	0.020	0.020	0.00
10	0.000	0.020	0.020	0.020	0.020	0.020	0.020	0.00
11	0.000	0.020	0.020	0.020	0.020	0.020	0.020	0.00
12	0.000	0.020	0.020	0.020	0.020	0.020	0.020	0.00
13	0.000	0.020	0.020	0.020	0.020	0.020	0.020	0.00
STREAM NUMBER	1	2	3	4	5	6	7	REALTIVE DIFFERENCE (%)
	ITERATION NUMBER							

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ITERATION TABLE
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PARAMETER NAME: MG/D (KG/M3)

STREAM NUMBER	ITERATION NUMBER 1	2	3	4	5	6	7	RELATIVE DIFFERENCE (%)
1	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.00
2	0.000	0.005	0.005	0.005	0.005	0.005	0.005	0.00
3	0.000	0.005	0.005	0.005	0.005	0.005	0.005	0.00
4	0.000	0.005	0.005	0.005	0.005	0.005	0.005	0.00
5	0.000	0.005	0.005	0.005	0.005	0.005	0.005	0.00
6	0.000	0.005	0.005	0.005	0.005	0.005	0.005	0.00
7	0.000	0.005	0.005	0.005	0.005	0.005	0.005	0.00
8	0.000	0.005	0.005	0.005	0.005	0.005	0.005	0.00
9	0.000	0.005	0.005	0.005	0.005	0.005	0.005	0.00
10	0.000	0.005	0.005	0.005	0.005	0.005	0.005	0.00
11	0.000	0.005	0.005	0.005	0.005	0.005	0.005	0.00
12	0.000	0.005	0.005	0.005	0.005	0.005	0.005	0.00
13	0.000	0.005	0.005	0.005	0.005	0.005	0.005	0.00
STREAM NUMBER	1	2	3	4	5	6	7	REALTIVE DIFFERENCE (%)
	ITERATION NUMBER							

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ITERATION TABLE

PARAMETER NAME: ALK/D (MEKV.)

STREAM NUMBER	ITERATION NUMBER 1	2	3	4	5	6	7	RELATIVE DIFFERENCE (%)
1	2.800	2.800	2.800	2.800	2.800	2.800	2.800	0.00
2	0.000	2.800	2.800	2.800	2.800	2.800	2.800	0.00
3	0.000	2.800	2.767	2.768	2.768	2.768	2.768	0.00
4	0.000	2.800	2.767	2.768	2.768	2.768	2.768	0.00
5	0.000	0.702	0.726	0.726	0.726	0.726	0.726	0.00
6	0.000	2.800	2.767	2.768	2.768	2.768	2.768	0.00
7	0.000	0.702	0.726	0.726	0.726	0.726	0.726	0.00
8	0.000	1.133	1.203	1.208	1.209	1.209	1.209	0.00
9	0.000	1.133	1.203	1.208	1.209	1.209	1.209	0.00
10	0.000	1.133	1.203	1.208	1.209	1.209	1.209	0.00
11	0.000	1.133	1.203	1.208	1.209	1.209	1.209	0.00
12	0.000	1.133	1.203	1.208	1.209	1.209	1.209	0.00
13	0.000	1.133	1.203	1.208	1.209	1.209	1.209	0.00
STREAM NUMBER	1	2	3	4	5	6	7	REALTIVE DIFFERENCE (%)
	ITERATION NUMBER							

ITERATION TABLE

PARAMETER NAME: PHZD

STREAM NUMBER	ITERATION NUMBER 1	2	3	4	5	6	7	RELATIVE DIFFERENCE (%)
1	7.200	7.200	7.200	7.200	7.200	7.200	7.200	0.00
2	0.000	7.200	7.200	7.200	7.200	7.200	7.200	0.00
3	0.000	7.200	7.088	7.087	7.087	7.087	7.087	0.00
4	0.000	7.200	7.088	7.087	7.087	7.087	7.087	0.00
5	0.000	5.900	5.900	5.900	5.900	5.900	5.900	0.00
6	0.000	7.200	7.088	7.087	7.087	7.087	7.087	0.00
7	0.000	5.900	5.900	5.900	5.900	5.900	5.900	0.00
8	0.000	5.994	6.007	6.008	6.008	6.009	6.009	0.00
9	0.000	5.994	6.007	6.008	6.008	6.009	6.009	0.00
10	0.000	5.994	6.007	6.008	6.008	6.009	6.009	0.00
11	0.000	5.994	6.007	6.008	6.008	6.009	6.009	0.00
12	0.000	5.994	6.007	6.008	6.008	6.009	6.009	0.00
13	0.000	5.994	6.007	6.008	6.008	6.009	6.009	0.00
STREAM NUMBER	1 ITERATION NUMBER	2	3	4	5	6	7	REALTIVE DIFFERENCE (%)

ITERATION TABLE

PARAMETER NAME: HYGIENE/S (0-10)

STREAM NUMBER	ITERATION NUMBER 1	2	3	4	5	6	7	RELATIVE DIFFERENCE (%)
1	10.000	10.000	10.000	10.000	10.000	10.000	10.000	0.00
2	0.000	10.000	10.000	10.000	10.000	10.000	10.000	0.00
3	0.000	10.000	9.804	9.797	9.796	9.796	9.796	0.00
4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
6	0.000	8.000	8.000	8.000	8.000	8.000	8.000	0.00
7	0.000	5.000	5.000	5.000	5.000	5.000	5.000	0.00
8	0.000	5.617	5.701	5.709	5.709	5.709	5.709	0.00
9	0.000	5.617	5.701	5.709	5.709	5.709	5.709	0.00
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
11	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
12	0.000	5.617	5.701	5.709	5.709	5.709	5.709	0.00
13	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
STREAM NUMBER	1	2	3	4	5	6	7	REALTIVE
	ITERATION NUMBER							DIFFERENCE (%)

ITERATION TABLE

PARAMETER NAME: ODOR/S (0-10)

STREAM NUMBER	ITERATION NUMBER 1	2	3	4	5	6	7	RELATIVE DIFFERENCE (%)
1	10.000	10.000	10.000	10.000	10.000	10.000	10.000	0.00
2	0.000	10.000	10.000	10.000	10.000	10.000	10.000	0.00
3	0.000	10.000	9.804	9.797	9.796	9.796	9.796	0.00
4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
6	0.000	8.000	8.000	8.000	8.000	8.000	8.000	0.00
7	0.000	5.000	5.000	5.000	5.000	5.000	5.000	0.00
8	0.000	5.617	5.701	5.709	5.709	5.709	5.709	0.00
9	0.000	5.617	5.701	5.709	5.709	5.709	5.709	0.00
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
11	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
12	0.000	5.617	5.701	5.709	5.709	5.709	5.709	0.00
13	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
STREAM NUMBER	1	2	3	4	5	6	7	REALTIVE DIFFERENCE (%)
	ITERATION NUMBER							

ITERATION TABLE

PARAMETER NAME: PPROT/S (0-10)

STREAM NUMBER	ITERATION NUMBER 1	2	3	4	5	6	7	RELATIVE DIFFERENCE (%)
1	10.000	10.000	10.000	10.000	10.000	10.000	10.000	0.00
2	0.000	10.000	10.000	10.000	10.000	10.000	10.000	0.00
3	0.000	10.000	9.804	9.797	9.796	9.796	9.796	0.00
4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
6	0.000	8.000	8.000	8.000	8.000	8.000	8.000	0.00
7	0.000	7.000	7.000	7.000	7.000	7.000	7.000	0.00
8	0.000	7.206	7.234	7.236	7.236	7.236	7.236	0.00
9	0.000	7.206	7.234	7.236	7.236	7.236	7.236	0.00
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
11	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
12	0.000	7.206	7.234	7.236	7.236	7.236	7.236	0.00
13	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
STREAM NUMBER	1	2	3	4	5	6	7	REALTIVE DIFFERENCE (%)
	ITERATION NUMBER							

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