U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45226

HEALTH HAZARD EVALUATION DETERMINATON
REPORT HE 79-39-641

NOVAMONT CORPORATION
KENOVA, WEST VIRGINIA

DECEMBER 1979

I. TOXICITY DETERMINATION

A Health Hazard Evaluation was conducted by the National Institute for Occupational Safety and Health (NIOSH) on February 7-9 and June 11-13, 1979 at Novamont Corporation, Kenova, West Virginia to determine the incidence of chronic neurologic disease in employees and to determine whether such a disease could have been caused by exposure to substances present at the plant. Methodology used in this evaluation included 1) inspection of workplace; 2) analysis of liquid bulk samples for solvent purity; 3) thermal degradation and particle size analysis of polymer powder; 4) review of personal medical records, administration and review of non-directed medical questionnaires; 5) neurologic examination of self-referred employees; 6) review of OSHA data and 7) review of literature and toxicity criteria.

No detectable impurities were found upon analysis of bulk samples of the two process solvents - methanol and heptane. Personal sampling for these solvents by OSHA in December of 1978 revealed exposure levels that were all below current health standards. Thermal gravimetric analysis of polypropylene powder revealed that thermal degradation products would not be expected to be generated under normal operating temperatures. Approximately 99.6% (by weight) of the polypropylene powder was greater than 10 microns in particle size.

There is no evidence that plant exposures are responsible for chronic neurologic disease in the workers surveyed. Past exposure to methanol fumes may have caused decreased visual acuity in one worker.

Initial review of non-directed medical questionnaires indicated an increased rate of hypertension (high blood pressure) in plant employees. Data subsequently provided by the plant physician covering the last 10 years collaborated this finding and showed an overall age adjusted rate that was approximately 1.3 times that of the general adult population. Therefore, a blood pressure screening program is recommended.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this report are currently available upon request from NIOSH, Division of Technical Services, Information Resources and Dissemination, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), Springfield, Virginia 22161. Information regarding its availability from NTIS can be obtained from NIOSH, Publications Office at the Cincinnati address. Copies of this report have been sent to:

a) Novamont Corporation
b) Local 3-74, Oil, Chemical and Atomic Workers International Union
c) U.S. Department of Labor, OSHA, Region III
d) NIOSH, Region III

For the purpose of informing the affected employees, copies of the report shall be posted in a prominent place accessible to the employees for a period of 30 calendar days.

III. INTRODUCTION

Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669 (a)(6), authorizes the Secretary of Health, Education, and Welfare, following a written request by any employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

NIOSH received such a request from a authorized representative of employees to evaluate the possible occurrence of chronic neurologic disease in 13 pre-identified employees and to determine whether disease, if found, could be associated with employee exposures at their workplace.

All 13 employees were allegedly experiencing numbness and stiffness in their arms and legs but with different degrees of severity. Extensive testing had been conducted on 3 employees at local hospitals but no clear diagnoses were made.

Personal sampling by OSHA for methanol and heptane in December of 1978 documented levels that were all below acceptable exposure criteria.

NIOSH interim report #1 was forwarded to management and the requestor in March 1979 containing:

1. A report of NIOSH activities up until March 1979 concerning this Health Hazard Evaluation.

2. Preliminary results of the non-directed medical questionnaire survey.

3. Recommendations that will upgrade the existing respirator program.

4. A statement of future actions by NIOSH which included that consultant neurologic services would be obtained to examine the pre-identified employees and that the plant physician had been requested to forward to NIOSH detailed data on the occurrence of hypertension and related diseases in the Novamont workforce.

IV. HEALTH HAZARD EVALUATION

A. Description of Facilities/Operation

Novamont Corporation, Kenova, West Virginia manufactures polypropylene pellets. Approximately 10% of their product is pigmented. Typically, the pellets are sold to other manufacturing companies who heat and mold the pellets into various plastic products.

A process flow chart is shown in Figure 1. Propylene is purchased or obtained by fractionization of liquid petroleum gas (LPG). The propylene is mixed with two catalysts and a carrier solvent and sent to the polymerization reactors. The resulting polymer is then purified, dryed and sent to the finishing and shipping building where it is mixed with various additives in the additive section in preparation for extrusion. The proper mixture is dropped into the extruding machine where it is heated to approximately 400°F and forced through a multiple orifice head. The "spaghetti-like" plastic material then travels through a water bath and into a pelletizing machine where it is cut into small pellets approximately 1/8 inch in length. The pellets are sent to the storage warehouse where they are packaged and held for shipment.

Samples are periodically taken at different stages of production for quality control analysis in the plant laboratory which is divided into 4 units; gas lab, chemical lab, physical lab and catalyst lab.

B. Evaluation Design and Methods

The following medical and environmental survey methods were selected to evaluate the occurrence of chronic neurologic disease in employees at Novamont and to judge whether such a disease, if found may be associated with exposure at the plant.

1. Medical

a. A standard NIOSH non-directed medical questionnaire was distributed to all plant employees to determine what medical problems and related exposures employees may have in common. The occurrence of peripheral neuropathy was of specific interest to determine if more than the 13 originally identified employees may have experienced such problems.

b. Those personnel who stated they felt they had job related medical problems were individually contacted by the NIOSH physician.

c. Neurological examination was arranged through a NIOSH medical service contract with Harvard School of Public Health. Ten self-referred employees were seen by each of 2 physicians. The physicians were to determine if any of the 10 employees had neurologic disease. Additionally, based on the information provided to them on plant exposures and information obtained during a walk-through inspection of the plant, they were to determine if these diseases were of occupational origin.

d. A literature review of those substance normally found in the work environment of the 13 employees was conducted to determine if any of the substances have been associated with neurologic disease.

2. Environmental

a. Liquid bulk samples of both process heptane and methanol were obtained and analyzed for purity using a gas chromatography equipped with a flame ionization detector.

b. A bulk sample of the polypropylene powder was obtained and submitted for thermal gravimetric analysis (TGA) and particle sizing. A Mettler TA-1 Thermoanalyzer was used for the TGA determination. An 82.29 milligram sample was placed in a platinum crucible in the furnace. The furnace was heated from 15 to 500^{o}C at 10 degrees per minute. Particle sizing was accomplished by running a weighed amount of polypropylene powder through a series of ultrasonic sieves.

c. Two bulk air samples were collected on charcoal tubes directly over a battery of carbo-wax oil baths in the gas lab. The exhaust fan servicing the hood above these baths was not working resulting in a noticeable odor in the gas lab area. The two charcoal tubes were submitted for gas chromatographic/mass spectrometry analysis to identify the evolving vapors.

d. A listing of all chemicals used at the plant was obtained and high use items were reviewed for toxicity. Ingredient information was solicited from the respective manufacturers on 15 chemicals used as additives. The specific names of the additives were regarded as proprietary information.

e. The results of OSHA's survey conducted in December 1978 were reviewed. It was decided that unless the medical evaluations indicated that there may be a problem in one or more areas that OSHA sampled, the sampling would not be repeated.

f. A walk-through inspection of the plant was conducted to observe working practices and conditions of exposure.

g. Noise measurements were obtained in the extruder area.

C. Toxicology

The following toxicology summary is limited to describing the known health effects from exposure to the polypropylene powder, methanol and heptane since these are the predominant sources of exposure for the employees with complaints of neurological disease. The many different chemicals used in the water treatment plant, power plant, laboratory and pigment area are not mentioned in this report because quantities used are small or none of the employees under evaluation spend a significant amount of time in these areas.

A review of literature on health problems asssociated with exposure to polymer dust revealed few reports of significance. One report[1] does mention a case of pneumoconiosis (progressive lung disease due to dust exposure) believed to have resulted from exposure to polyvinyl chloride dust. Aerodynamic characteristics of the dust or powder such as particle size and density would be determining factors in evaluating the potential of a dust for reaching the lung. It is generally accepted that polypropylene is inert in its pure form.[2] The decomposition products of polypropylene will start to evolve at approximately 400°F and have been identified as primarily carbon dioxide and carbon monoxide with short chain hydrocarbons such as methane, ethylene, ethane, propylene and propane also being present in smaller quantities.[3] The major hydrocarbon present is propylene. At 1600°F complete combustion occurs resulting in formation of carbon dioxide and water.[4] The decomposition products of the finished product would depend on the composition but would not be a problem under normal operating conditions since process temperatures are kept low enough to prevent thermal decomposition.

Methanol exposure has been associated with headaches, dizziness, nausea, vertigo and ataxia (unsteadiness) which tend to resolve shortly after acute exposure.[5] High levels of methanol exposure is also associated with visual disturbances, including transient visual blurring, constriction of visual fields, changes in color perception, and in more severe cases, blindness[6]. Epidemiologic studies of visual effects of chronic exposures have not been performed. Metabolic acidosis leading to death has been reported, particularly following inadvertent injestion of methanol. Prolonged or repeated skin contact can cause dermatitis, erythema and scaling.

Heptane although chemically similar to the known neurotoxin n-hexane, has not been found to cause damage to the nervous system in animals or humans.[7] Skin contact does cause irritation and blister formation[8]. Airborne exposure of animals to heptane results in narcosis and with high concentrations death.[7] Humans exposed acutely to heptane vapor develop vertigo at concentrations of 1000 ppm which becomes more severe and is associated with incoordination and euphoria as concentrations increase to 5000 ppm[9].

D. Evaluation Results and Discussion

1. Medical

a. Questionnaire Results: A total of 225 questionnaires were forwarded for distribution. Sixty-four (25%) were returned. Results of the non-directed medical questionnaire survey are presented in Table 1. The questionnaires were designed to obtain information on the general state-of-health of the work force as well as specific health problems that may be related to exposures on the job. The predominant health problems identified on the questionnaires were 11 employees complaining of hypertension and seven employees complaining of the neuropathy type problem. Of the 7,3 worked in the lab, 3 were janitors and 1 was a maintenance man.

All thirteen employees originally identified as those experiencing neurologic health problems were among those contacted. Seven were personally interviewed by the NIOSH physician at the time of the initial survey and the other six were contacted by phone or letter. Only seven of the 13 acknowledged that they had experienced numbness and stiffness in their arms and legs. Three of these seven were hospitalized. Medical records on these three have been reviewed. No new potential cases of similar type medical problems were uncovered either through the use of questionnaires or personal interviews.

One employee in the additive section was concerned that his kidney stone problem may have been precipitated by exposure to the calcium stearate additive he routinely handles in dust form. There is no evidence linking inhalation of calcium dust to stone formation.[14] However, hot, dry environments have been thought to lead to stones. It is of interest that one need not injest excess calcium to be at risk for stone formation. Genetic hypercalciuria (a hereditary condition where one has increased calcium in the urine) for example, is perhaps the most predisposing factor leading to formation of calcium stones in the kidney and will manifest itself under conditions of normal diet.

b. Hypertension Evaluation: The best available retrospective estimate of the prevalence of hypertension in the plant was provided by the plant physician by reviewing plant medical records over the past 10 years. The estimate represents an under-reporting of cases since only employees who voluntarily requested to be screened are included. The plant population is stable, therefore, it is reasonable to use the figures provided by the company to estimate the prevalence of hypertension.

The expected number of cases of hypertension (BP>140/90) was derived from the Health Examination Survey Data Base for the United States 1960-62[10]. The expected rates were adjusted for the age distribution of the Novamont population and compared to those observed. Overall, the plant population had a age adjusted rate of hypertension approximately 1.3 times that of the general adult population. Various explanations for the increased morbidity include; diet, genetics, environmental factors as well as occupational factors including shift work, chemical exposure, etc. Appendix A contains the procedures and the data generated for this hypertension study.

c. Review of Plant Medical Records: Medical records at Novamont Plant consist of a log of the patient's name, including complaint and treatment. This one line medical record does not provide the information often needed in industrial setting concerning job placement, health maintenance, workers' compensation, rehabilitation and epidemiology. Information for the development of an Industrial Medical Record System is found in many sources.[11,12,13]

A physician is available one hour each week at the plant. Ten to 12 workers are seen in that hour leaving approximately 5 minutes per patient. More physician contact time should be secured to provide sufficient time for needed medical care.

D. Neurological Evaluation: Results of the neurological evaluation of the 10 self-referred employees was extracted from the contractor report and is presented in Table 2.

Individual symptoms varied considerably and no consistent temporal relationships were noted between development of symptoms and exposure in specific work areas, or specific chemicals in the plant. Three workers (cases 2,5, and 7 -Table 2) had episodic asymmetrical numbness of hands or feet lasting 12 hours or less; these workers had variable, minor abnormalities on physical examination which were unlikely to be related to a peripheral neuropathy. Two workers (cases 3 and 4) had episodic, symmetrical sensory distrubances (cramps, tingling, and/or numbness) with a normal physical exam. One worker (case 6) with a history of back pain, had lower extremity numbness and weakness consistent with a lumbar disc syndrome. Another worker (case 9) had right knee pain associated with exercise consistent with a diagnosis of bursitis or arthritis. One worker, with a history of persistent, asymmetric numbness and weakness of the trunk and extremities, was recently diagnosed as having multiple sclerosis. Only one worker had symptoms consistent with classical toxic peripheral neuropathy (case 8); however, he had a normal physical examination.

In summary, five workers had experienced transient episodes of sensory disturbances. Four of the five were asymptomatic at the time of the physical examination which revealed no significant abnormalities. No recognizable neurological clinical illness in these five workers were found. Three workers had symptoms or signs consistent with nonocccupational disease: bursitis, lumbar disc disease, and multiple sclerosis. One worker with a history consistent with toxic peripheral neuropathy had no objective evidence of impaired motor or sensory function.

One worker (case 1) related a history of blurred vision for the past seven years, dating from a period when he worked in the distillation area where he describes heavy exposure to methanol. He related that during this period, he experienced headaches and at times a whoozy feeling, particularly on those occasions when he was required to be exposed to methanol during the process of cleaning out one of the reaction vessels. Due to the limited nature of the evaluation, careful ophthalmologic examination was not performed. His history is, however, consistent with methanol toxicity due to occupational exposure several years ago. The worker was encouraged to seek a detailed opthalmologic examination, and to transmit the report of that examination to us for a more complete assessment of his case.

None of the chemicals used at the plant have been reported as definite causes of peripheral neuropathy. Methanol was felt in an early report to be associated with peripheral neuropathy, but the purity of the product used was not established. That report published in 1904 was not followed by any further reference to this compound being associated with the peripheral nervous system. Although heptane is somwhat similar chemically to the known neurotoxin n-hexane, there have been no reports of heptane causing peripheral nervous system problems.

2. Environmental

a. Results of Bulk Sample Analysis: Process heptane and methanol were analyzed for purity. No impurities were detected.

Thermal gravimetric analysis was used to determine weight loss as temperature increases. There was no weight loss until 220°C (428°F). From 220°C to 465°C (869°F), a rapid weight loss was observed with an onset temperature of 325°C. The weight loss accounted for 99.6% of the original weight. Further heating to 500°C resulted in an additional 0.4% weight loss.

The powder presented difficulty when dry sieving due to static electricity. A loss of 13.6% occurred which obviously casts some doubt on the following data.

Particle Size	%
> 74 microns*	58
on 37 micron sieve	25
on 10 micron sieve	3
< 10 micron	0.4

*74,37,10 microns are mesh sizes for the sieves used.

There should not be a problem with exposure to thermal-degradation products since process temperatures are kept low enough to prevent this from happening.

The particle size analysis performed on the pure polymer powder indicates that a portion of the dust is of respirable size. It is suspected that the amount would be greater than the 0.4% indicated since the stated static electricity problem would have a greater effect on the smaller particles. Polypropylene powder, in pure form could be classified as a nuisance dust.

The dust from the various additives and pigments offer more potential for health problems. Proper handling procedures as well as using protective equipment such as respirators, gloves and aprons are necessary in this area. Laxity in the use of the proper procedures and protective equipment may result in skin and eye irritation, inflammation of the upper respiratory system and possibly sores in the mucous membrane lining the upper respiratory pathways.

b. Area Sampling Results: Analysis of the charcoal tube area samples taken in the hood in the gas lab where the isotactic index is determined showed that the odors in the lab due to the exhaust fan in the hood being broken were a mixture of heptanes. Normal-heptane was identified as the largest component found. Other compounds identified include additional C_7H_{16} isomers such as dimethylpentanes and methyl hexanes plus a cyclic C_7H_{14} compound identified as methyl cyclohexane. These vapors can cause central nervous system depression. The hood fan had been repaired before the time of our follow-up survey.

c. Personal Sampling Results: The results of the personal sampling for methanol and heptane accomplished by OSHA during their December 1978 survey are presented in Table 3 and 4. The heptane results are in Table 3 and the methanol results are in Table 4. The levels reported were all below acceptable exposure criteria.

d. Extruder Area, Chemical Exposure: NIOSH has evaluated at least three other plastic plants where various types of plastics were being extruded[15,16,17]. A long list of possible contaminants were looked for in the extruder area:

Carbon Monoxide	Aromatic Amines
Acrylonitrile	Aliphatic Amines
Hydrocarbons	Aldehydes
Nitrogen Dioxide	Phthalates
Formaldehyde	Butadiene
Phenol	Styrene
Benzene	Metals
Ozone	Total Particulates
Hydrogen Cyanide	Isocyanates
PolyVinyl Chloride	

No significant amounts of any of these were detected which indicates that under normal operating conditions the extruding area does not present a hazard from agents evolving from the molten plastic. Thermal-degradation could cause a health problem if the extruder temperatures reached in excess of 500°F. Should this occur, the area should be evacuated and all those involved in the maintenance activities should be equipped with fresh air supplied masks.

e. Extruder Area, Noise Exposure: Several noise readings were taken in the extruder area on June 12, 1979. Two extruders were down for repair and two exhaust fans were inoperative. Readings were taken with a General Radio 1565 Noise Meter on the dBA, slow scale. The meter was calibrated prior to the survey with a General Radio 1562 acoustic calibrator.

Measured levels ranged from 91 to 105 dBA. The higher readings were obtained in the immediate area of the pelletizing machines. These machines were housed in acoustic enclosures; however, the effectiveness of the enclosures was defeated due to panels left off or doors left open to facilitate maintenance tasks. The extruder operators were wearing ear protection on the day of the survey.

The Occupational Safety and Health Administrative (OSHA), by authority granted under the Occupational Safety and Health Act of 1970, has established regulations for worker noise exposure. OSHA regulations state that occupational noise exposure should not exceed 90 dBA for one 8-hour work period on a time-weighted average basis. Higher levels are permitted for shorter periods of time as follows:

Duration per day in hours	Maximum Allowable Sound Level (dBA)
8	90
6	92
4	95
3	97
2	100
1	105
1/2	110
1/4 or less	115

Consequently, noise exposure may vary, but the time-weighted average should not exceed 90 dBA for a 8-hour period.

f. Respirator Program: Some deficiencies in the respirator program were noted in the interim report. In general the problems related to poor condition of the respirators being used. Employees in the additive area for example were using respirators for days without cleaning or change of filters. This program was upgraded by the time of our follow-up visit. A turn-in schedule was instituted which will help insure that each individual has a serviceable respirator. Some of the face shields used in the forced air face masks in the certrifuge areas were replaced. The old ones were scratched to the point where visibility was restricted. A storage box was placed in the centrifuge area to keep the masks clean until needed for maintenance of the centrifuges.

V. CONCLUSIONS

Although the prevalence of abnormal sensation in the extremities seems unusual in this plant, the transient and asymmetric nature of the symptoms makes it unlikely that these complaints are due to a peripheral neuropathy of toxic origin. Furthermore, none of the three workers with mild physical findings consistent with a diagnosis of neuropathy had also experienced a symptom complex usually seen with peripheral neuropathy. Finally, since these workers were self-selected, we were unable to assess the true prevalence of symptoms in the plant and to compare it with the prevalence of symptoms in unexposed workers.

The only major impairment of health which may well be related to a chemical exposure at the plant was that seen in the worker who complained of diminished visual acuity dating from a period when he had been exposed to methanol in his job. The acute symptoms described by this woker have been previously associated with excessive exposure to methanol. In those instances where visual impairment has been reported, sometimes the damage was transient and, at other times, permanent derangements have resulted. Since no objective assessment of the visual acuity was performed in this one individual, no definitive statement can be made about the nature and extent of his disability.

In the opinion of the medical investigators, there is no evidence to suggest that current plant exposures are responsible for chronic neurologic disease in workers who were surveyed at the plant.

Other substances used at the plant which might have neurotoxic potential are the pigments used to color the product according to customer demands. Some of these appear to contain lead. None of the employees evaluated were pigment operators.

VI. RECOMMENDATIONS

1. There should be no instance where an employee has to be exposed to even a short term high level of solvent vapor. There are specific tasks that need to be done on a routine (most cases daily) basis that have the potential of causing high short term levels of both heptane and methanol. Tasks in areas 2, 3 and 4 such as; cleaning plugged catalyst pumps, changing pump baskets, changing hot heptane filters and cleaning headers and effluent lines can result in exposure to high levels of heptane. Tasks in areas 6 and 7 such as changing seal filters, working on the vertical and horizontal centrifuges, cleaning cakes and cleaning day filters can result in exposure to high levels of methanol. Experiencing such air exposure may result in becoming dizzy and even in the temporary loss of conciousness. It is therefore recommended that forced fresh air masks be available and readily accessible for the performance of such tasks.

2. The practice of leaving containers of solvent uncovered in the various labs should be discontinued and a hood system should be provided in the labs where the powder bags can be opened for transfer to analytical containers.

3. First-line supervisors need to more closely supervise the use of half masks for dust protection to insure that the masks used are providing the expected degree of protection. Past experience concerning the practice of issuing a protective mask to an individual with the understanding that he has the full responsibility for keeping it clean and seeing that it is kept in good working order has seldom been successful, especially when the environmental contaminant does not elicit strong acute symptoms. The basic elements of a complete respirator protection program are briefly outlined below. Operating procedures should be developed describing these aspects:

    . The basis for selection of a specific type of respiratory protective equipment.

    . Provision for medical screening of each employee assigned to wear respiratory equipment to determine if he/she is physically or psychologically able to wear a respirator.

- Provisions for assigning respiratory protective equipment to employees for their exclusive use, where practical.
- Provisions for testing for the proper fit of the respiratory protective equipment.
- Provisions for regularly cleaning and disinfecting the respiratory protective equipment.
- Provisions for proper storage of respiratory protective equipment.
- Provisions for periodic inspection and repair of respiratory protective equipment.
- A periodic evaluation by the administrator of the program to assure its continued functioning and effectiveness.
- An employee training program in which the employee can become familiar with the respiratory protective equipment, and be trained in the proper use and the limitations of the equipment.

4. The exposures in the pigment area should be evaluated. Some of the pigments used may contain carcinogens or mutagens. The extent of exposure to these must be evaluated. The pigment operator should wear a high efficiency particulate filter when engaged in the weighing of pigments. Pigments should be obtained in pellet form if possible.

5. The noise levels in the extruder area are in excess of the current OSHA 90 dBA standard. It is recommended that until such time as these levels are reduced, the wearing ear protectors should be enforced and a hearing conservation program started immediately for those personnel assigned to this area. As a minimum, baseline and yearly audiograms should be obtained on extruder operators.

6. Due to the variety and undetermined toxicity of the various chemicals and combinations of chemicals handled in the 2nd and 3rd floor of the finishing and shipping building, it is recommended that, as a minimum, chest X-rays and simple pulmonary function testing be done on a yearly basis for those personnel who handle the pigments or additives.

7. The plant medical records should be upgraded to provide more information and more time should be provided for employee appointments with the plant physician.

8. A blood pressure screening program is recommended to detect and treat workers with hypertension as well as to try to determine the etiology of the possibly increased incidence. An attempt should be made to relate cases of high blood pressure with specific process areas or exposures.

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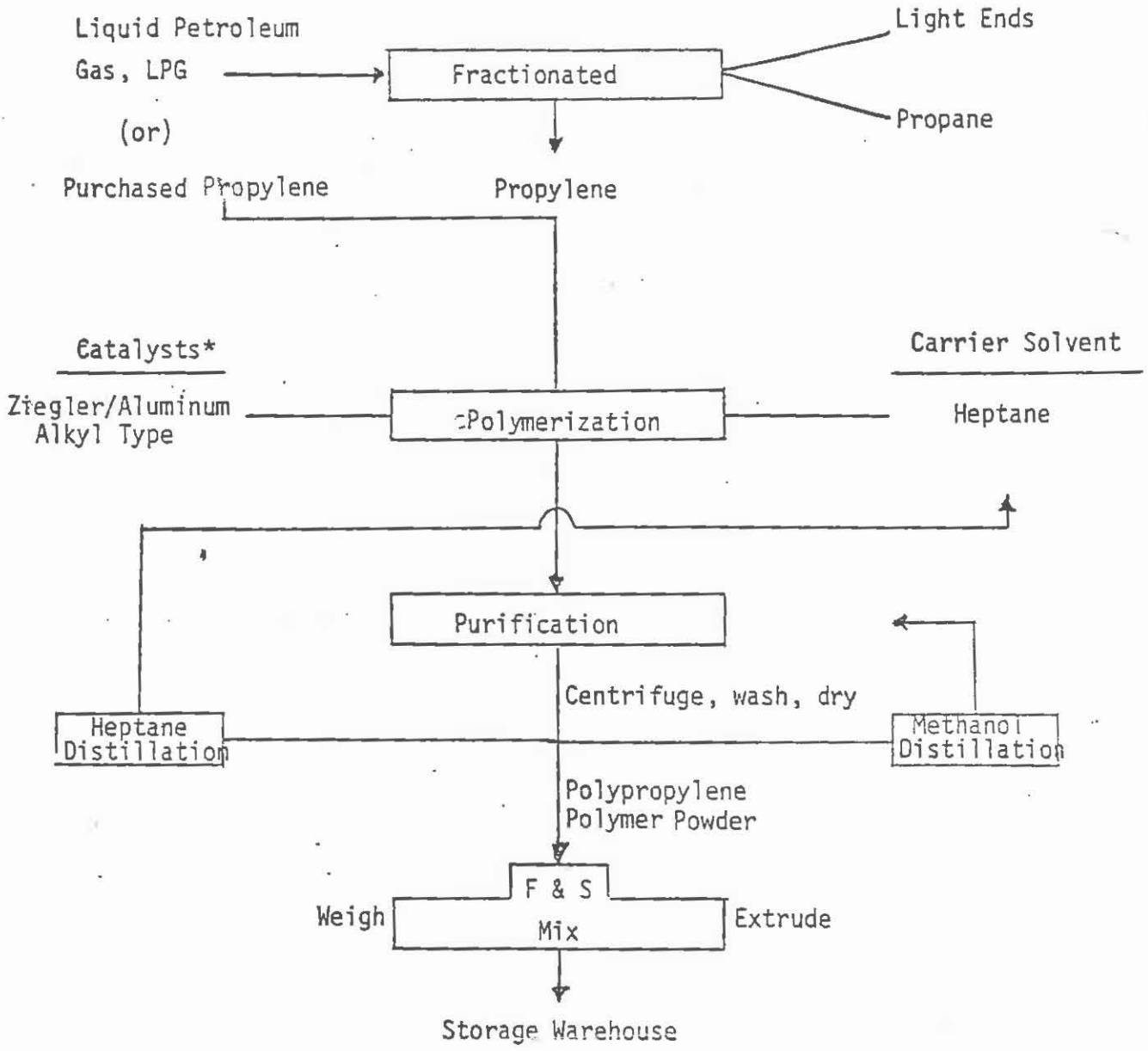
Figure 1

Process Flow Chart
Novamont Corporation



*Catalyst identity proprietary. The specific catalyst were evaluated for toxicity.

TABLE I

PRELIMINARY QUESTIONNAIRE DATA
NOVAMONT CORPORATION
HHE NO. 79-39

	UNION	MANAGEMENT	TOTAL
Number Of Questionnaires Sent To Plant Representatives For Distribution	180	75	255
Number Of Questionnaires Returned	36	27	64
Number Of Employees Who Identified Some Type Of Health Problem	20	6	26
Number Of Employees Who Felt Their Health Problems Were Related To Work	16	0	16
Number Of Employees Interviewed By A NIOSH Physician	14	-	14

DISTRIBUTION OF HEALTH PROBLEMS IDENTIFIED ON QUESTIONNAIRES:

Hypertension - 11
Peripheral Neuropathy Disorders - 7
Nervousness - 5
Allergies - 4
Eye Problem - 3
Headaches - 4
GI Problem - 2
Arthritis - 1
Kidney Stones - 1

Table 2

Summary of Neurological Exams

Case	Age	Duration of Employment	Work Area	Chemical Exposures*					Symptoms	Abnormal Physical Findings**
				Methanol	Heptane	Xylene	Diethyl Alum.	$TiCl_3$		
1	<40	10+	Entire plant laborer	H	?	?	?	?	Blurred vision x 7 yrs following heavy methanol exposure	Decreased hearing right ear, possible decreased vibration sensation, possible decreased pain sensation right hand (visual acuity not tested).
2	<40	<10	Entire plant janitor	Y	Y	N	Y	Y	Episodic numbness right leg and arm	Diminished vibration sensation both arms, possible diminished vibration sensation both legs.
3	40+	10+	Chemistry laboratory	Y	Y	Y	Y	Y	Episodic toe cramps & restless feeling in feet	Possible diminished vibration in both lower extremities, possible diminished pain sensation in left foot.
4	<40	10+	Chemistry laboratory	Y	Y	?	Y	Y	Episodic numbness in feet, legs, and hands	NONE
5	<40	<10	Janitor	Y	Y	?	Y	?	Episodic numbness in left & left upper arm	Diminished vibration sensation in both legs, diminished pain sensation in right hand.
6	40+	10+	Distillation plant operator	?	?	?	?	?	Episodic numbness in left hand, 4th & 5th fingers; history of "back trouble"	Weak right anterior lower leg muscles, diminished vibration & pain sensation both lower extremities.
7	40+	<10	Color operator	N	N	N	N	N	Episodic tingling of right hand on one occasion	NONE
8	40+	10+	Physical laboratory	Y	Y	N	N	N	Persistent tingling of feet & legs for 2 yrs.	NONE
9	40+	10+	Physical laboratory	Y	Y	?	Y	?	Episodic pain in right knee with exercise	Diminished hearing both ears, left worse than right, possibly diminished sensation arms & legs, possibly area of decreased pain perception, left arm.
10	<40	10+	Chemistry laboratory	Y	Y	Y	Y	Y	Numbness & weakness in left arm, hand, & leg	Diminished hearing left ear.

*Exposures: Y=exposed; H=heavy exposure; ?=exposure status unknown; N=not exposed.

**Findings listed were noted by both examiners, except where noted as "possible."

Table 3

Heptane Results

OSHA Survey, December 1978
Novamont Corporation

Job Description	Sampling Time min.	Sample Volume liters	Concentration TWA (ppm)
gas lab technician	465	31.1	N.D.*
gas lab technician	463	39.8	N.D.
physical lab technician	440	42.4	N.D.
chemical lab technician	462	34.6	N.D.
gas lab technician	452	34.1	N.D.
purification operator (up)	442	34.9	54.0
purification operator (down)	457	38.4	10.2
distillation operator (methanol)	453	39.8	N.D.
distillation operator (heptane)	448	39.4	N.D.

*N.D. - not detectable

Health Standard	NIOSH	85 ppm, 8-hr.,TWA
	OSHA	500 ppm, 8-hr.,TWA

Table 4

Methanol Results

OSHA Survey, December 1978
Novamont Corporation

Job Description	Sampling Time min.	Sample Volume liters	Concentrations TWA (ppm)
gas lab technician	459	436	N.D.*
gas lab technician	443	445	N.D.
chemical lab technician	319	418	N.D.
physical lab technician	466	483	N.D.
purification operator (up)	435	653	136.5
purification operator (down)	439	615	41.6
distillation operator (methanol)	441	662	10.0
distillation operator (heptane)	433	606	21.9

*N.D. - not detectable

Health Standard	NIOSH	200 ppm, 8-hr.,TWA
	OSHA	200 ppm, 8-hr.,TWA

Appendix A

The age-specific rates of hypertension in the Novamont workforce were compared with those that would be expected if the workforce had experienced the same rates of the US male population for 1960-62. The indirect method of age-adjustment was used to apply these age-specific vs rates for hypertension to the Novamont age distribution to yield the expectation of 33.12 cases of hypertension; 43 cases were actually observed. The number of cases observed is 30% greater than that expected and was most pronounced in the group aged 25-34.

Age	US Male hypertension rate (%)	Novamont workforce population	Number of cases of hypertension observed	Number of cases of hypertension expected
18-24	1.7	9	0	0.15
25-34	4.8	79	9	3.79
35-44	13.5	72	14	9.72
45-54	18.3	71	16	12.99
55-64	22.3	29	4	6.46
65-74	27.1	0	0	0
74+	32.4	0	0	0
		260	43	33.12

$$\frac{\text{Observed cases hypertension}}{\text{Expected cases hypertension}} = \frac{43}{33.12} = 1.30 \text{ or } 30\% \text{ greater}$$