USED OIL RECYCLING IN THE YUKON

April 1990

Yukon
Renewable Resources

By:

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Government of the Yukon
Renewable Resources
Policy and Planning Branch
P. O. Box 2703
Whitehorse, Yukon
Y1A 2C6

Attention: Mr. Walter A. Bilawich
Coordinator, Special Projects

Dear Sirs:

Re: Used Oil Recycling in the Yukon

We are pleased to submit herewith our final report on used oil recycling in the Yukon.

The report includes an inventory of used oil in the Yukon, present applications and availability of the oil for recycling. It also includes discussion on collection and recycling alternatives.

We hope the study will be useful in providing direction and some basis for developing appropriate guidelines and future regulations concerning the recycling of used oils in the Yukon.

Yours very truly

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1.0 INTRODUCTION

The need for proper management of used oil in the Yukon has become increasingly apparent in recent years. A relatively large quantity of used oil is generated and is often disposed of in improper, wasteful and environmentally damaging ways.

If used oil in the Yukon is recycled, benefits would be realized by reducing waste disposal problems and associated environmental concerns. Also, by treating the oil as an energy source, it can be considered a resource rather than a "waste" and, in a small but significant way, would reduce our overall consumption and dependency on petroleum products.

This study was commissioned by the Department of Renewable Resources, Government of the Yukon to research the availability of used oil generated in the Yukon, and to investigate options for collection, storage and recycling (reprocessing, rerefining and reusing).

The study terms of reference are more specifically outlined as follows:

1. Inventory of quantity/quality and type of used oil generated in Yukon communities and large industrial operations in the Yukon.

2. Logistics of developing a community disposal/storage system for Yukon communities including collection of used oil products and transfer to one of the following:
   a) central processing plant located in Whitehorse to treat and refine the product into usable fuel for heating purposes (Shurtleff Refiner).
   b) transfer to Turbo Edmonton, Mohawk Vancouver recycling plants or Dawson Creek, B.C.

3. Quantities consumed by existing used oil burning equipment should be included in the process. Any savings to those operations should be identified.

These topics are covered in the ensuing chapters by first exploring the availability of used oil in the Yukon and present applications. Then options for collection of oil are examined plus recycling alternatives with discussion and suggestions in the Executive Summary.

2.0 EXECUTIVE SUMMARY

This used oil recycling study has as its objectives an inventory of quality, quantity and type of used oil generated in the Yukon and the logistics of developing a community disposal/storage system and a transfer system. In addition, we were requested to estimate the quantity of used oil consumed by used oil burning heating equipment and the economic benefit to the operators.

The study objectives are related but differ in study requirements and methodology. The inventory of used oil generated in the Yukon was conducted primarily by a telephone survey of major generators of used oil, including contractors, utilities, the transportation industry and service and repair garages. We had to estimate other quantities of used oil such as that produced by do-it-yourself home mechanics. We attempted to double check our estimates by acquiring data on oil sold in the Yukon and comparing our data with data gathered from earlier studies. We generated two figures in this inventory: used oil generated, and used oil available for recycling. Our survey indicates that less than 30 percent of the used oil generated is available for recycling.

The reasons for the low availability and options for improving recovery are discussed later in this summary and more fully in the body of this report. The logistics of developing a community disposal/storage system and a transfer system to a central processing plant were difficult to analyze and tended to raise more questions than solutions. The options for the use of the oil, the variable quantities and location of the used oil, the uncertainty of recovery rates and other influencing factors tended to create a matrix of options that could only be properly solved with the guidance of a used oil management plan. We contacted other jurisdictions and reviewed literature on the subject to attempt to form some answers.

The CCME, Code of Practice for Used Oil Management in Canada, Chapters 3 and 4, describe the collection, transportation and handling of used oil. Although some of the recommendations are applicable to the Yukon, the small quantities generated over a large scattered area make other recommendations impractical. We do not feel that we were able to adequately fulfil the objectives of the study with respect to the disposal/storage and transfer of used oil in the Yukon but we hope that some of the concerns raised will be of benefit when a used oil management plan is drafted.

The indicated low percentage of used oil available from the used oil generated may be a concern at first glance because it is almost equal to the percentage of oil wasted to disposal pits, and indiscriminate dumping. To reduce the potential of environmental damage from used oil, and for some methods of oil reuse, the percentage of recovery should be maximized. It is interesting to note that our research indicated that approximately 37 percent of the used oil generated is presently being used as fuel for heating purposes. Although there are some environmental concerns over this practice, it has occurred primarily because of the economic benefit to the public of a low cost fuel source and not to solve oil disposal problems. The low indicated availability is likely due to the lack of any legislation and lack of public concern with respect to used oil disposal.

We recommend that a used oil management plan be drafted that encompasses public education, legislation controlling the disposal of used oil with options available for use or reuse of used oil, establishment and licensing of used oil disposal sites and possibly, an economic incentive program to maximize used oil recovery.

The request for proposal had a predilection to disposing of used oil through a central processing plant, either in the Yukon or outside the Yukon. This would necessitate the establishment of a territory-wide collection and transportation system. The cost of moving small quantities of used oil would have a negative value, particularly if transported outside the Yukon for processing, and would require government support for the system.

We believe a used management plan should consider the economics and benefits of collecting oil from different areas in the Yukon through a government-managed and operated system. It should also consider the encouragement and support of the private sector to collect, transport and process used oil. A combination of the above may be appropriate. For instance, in remote communities, it might be desirable for the government to establish collection systems and/or used oil depots and allow used oil burning by the private sector and government facilities. Many remote government grader stations could dispose of their oil, plus possibly the oil in the district, through used oil burners.

For communities close to Whitehorse, a central collection program may be appropriate. Where practicable, and keeping within all environmental guidelines, we believe that the private sector should be encouraged and supported in efforts to collect, reuse and/or recycle used oil products. This may evolve naturally through a process of appropriate legistation and education.

The results of our study indicate that using used oil burners is the most practical and economical used oil disposal method in all areas of the Yukon, with the possible exception of Whitehorse. In a relatively high population area such as Whitehorse, stack emissions from oil burners may not be acceptable, particularly if large volumes of used oil are being burned. Air pollution problems could also result without proper controls on burner locations, density and types. We recommend that further studies be carried out on the acceptability of this practice. In particular, it would be useful to determine the quantity and type of emissions from used oil burners in comparison with other emissions that presently occur (i.e. automobiles and other types of fuel burning appliances).

3.0 USED OIL DEFINITION

The Code of Practice for Used Oil Management in Canada defines used oil as coming from industrial and non-industrial sources which has been acquired for lubricating or other purposes and has become unsuitable for its original purpose due to the presence of impurities or the loss of original properties. The following categories of used oil are covered by the Code of Practice:

- lubricating oils (engine, turbine or gear);
- hydraulic fluids (including transmission fluids);
- metal working fluids (including cutting, grinding, machining, rolling, stamping, quenching and coating oils); and
- insulating fluid or coolant (e.g. transformer fluid).

For the purposes of the inventory in this study, the first two categories were emphasized since the quantities of oil in the latter two categories (i.e. metal working fluids and insulating fluids) were considered to be comparatively insignificant for most Yukon operations.

At present, Quebec, Ontario and Nova Scotia have legislation that deals specifically with used oils. The remaining provinces and the territories do not have any legislation which deals with used oil management.

4.0 STUDY METHODOLOGY

The inventory of used oil generated in the Yukon Territory was obtained from telephone contact with the following operations:

* Trucking (including truck repair and rentals)
* Construction Industry
* Placer Mining
* Remote Highway Gas Stations/Lodges
* Federal Government Operations
* Bus Lines
* City of Whitehorse
* NorthwesTel
* Yukon Electrical Company Limited
* Service Stations/Auto Repairs/Taxis
* Hardrock Mining Operations
* Government of the Yukon
* Air Transport

In carrying out the research, the questionnaire on the following page was used and was completed for every operation contacted. Approximately 150 contacts were made during the course of the study.

The telephone interviews were used to obtain data on used oils generated, application and availability of used oils plus information on present disposal problems and whether the agency would be willing to deliver used oils to a drop-off site.

In general, most persons contacted were cooperative in supplying information and we feel the numbers obtained are fairly reliable. However, it must be realized that it is practically impossible under the terms of this study to make contact with every user of oil in the Territory. Therefore, for some operations and users, certain assumptions and estimates were made as discussed in detail in the following section.

Based on the inventory work, an estimate was made on the availability of used oil for recycling. Following this, research was carried out on collection and recycling of used oil through reference material, contacts with various agencies and individuals and use of in-house knowledge.

QUESTIONNAIRE
FOR WASTE OIL

Date: _____
Contact: _____
Type of Business: _____
Telephone No.: _____
Location: _____

Type of Waste Oil: Quantity

- o Lube Oil _____
- o Solvents _____
- o Contaminated Fuels _____

1. What is done with the waste oil now? _____
2. Could this waste oil be made available for recycling? _____
3. How much of it could be made available? _____
4. Are there problems with present disposal methods? _____
5. If there was a drop off site for recycleable oil, would your company be willing to deliver the waste oil to the site? _____
6. If there was a criteria involved to maintain a certain standard of waste oil, would your company be prepared to co-operate. i.e. Don't dump antifreeze into the waste oil container. _____

Comments/Suggestions: _____

5.0 INVENTORY OF USED OILS

In Table 5.1 on the following page is a summary breakdown of estimates of used oil generated and used oil available based on the research carried out. The used oil figures include lubricating and hydraulic fluids. . Solvents and other insulating fluids were not included since the amounts used are relatively small and difficult to obtain figures on. In order to arrive at the data, estimates and assumptions had to be made in certain cases. Each category is described as follows:

1. Private Vehicles:

It is difficult to determine the actual amount of oil available for recycle from private vehicles. It was assumed that 5-10% of vehicle owners change their own oil. This oil is disposed of in a variety of ways. A small amount is taken to local garages and put in with their used oil to be used in burners (i.e. Mic Mac Motors, Whitehorse). Most of the remaining oil is either taken to the dump or disposed of in green belt areas.

Although a large number of contacts were made with service stations to determine used oil generated from light duty vehicles, it was impractical to contact every station. Accordingly, the number of registrations for all cars and light trucks was obtained and it was assumed that 5 L were obtained per oil change, twice per year (average). This figure was compared to the data obtained from contacts with stations in the Whitehorse area to arrive at an approximate figure as indicated in Table 5.1.

Twenty service stations, auto repair shops and taxi operators were contacted in the Whitehorse area, which resulted in 180,500 L/yr. of used oil being generated from these sources. Of this amount, 66,910 L/yr. were reported as being available for recycling. The study showed that about 44,000 L/yr. are already being used in used oil furnaces (i.e. Mic Mac Motors, Whitehorse Motors and Yukon-Alaska Transport) and dust control. Based on the present usage of used oil (mainly in Whitehorse) and after estimating the overall used oil generated by private vehicles, a figure of 72,500 L/yr. was estimated as being available for recycling from this source for all of the Yukon.

TABLE 5.1

USED OIL GENERATED AND AVAILABILITY

Category	Used Oil Generated L/yr.	Used Oil Burned L/yr.	Used Oil Available L/yr.	% of Generated Available L/yr.	Comments
1. Private Vehicles	180,500	44,000	72,500	40	Large percentage already used in burners, dust control and disposed of.
2. Trucking Companies	88,800	50,000	20,000	22	Large percentage used in burners and some used for dust control.
3. Truck and Heavy Equipment Repair and Leasing	50,600	2,000	41,000	81	High percentage available for recycle but some is contaminated.
4. Hardrock Mining	234,480	200,000	Considered Nil	0	Curragh uses all used oil in burners and for dust control. Canamax has used oil, but difficult to access.
5. Placer Mining	90,000	Nil	Considered Nil	0	High generation of used oil but poor prospects for collection and recycle at this time. However, possibly good potential for reuse in the future.
6. Yukon Government	68,330	25,000	43,330	63	Two used oil burners in Whitehorse and Watson Lake presently consume about 25,000 L/yr.
7. Federal Government	2,330	Nil	1,880	81	Most federal government vehicles serviced at private service stations.
8. City of Whitehorse	2,250	Nil	2,250	100	All of this oil is available for recycle.
9. Yukon Electrical Company and Yukon Energy Corporation	13,860	7,500	5,360	39	Thirty-three percent of generated oil already used in Northern Kat's burner in Dawson.

Category	Used Oil Generated L/yr.	Used Oil Burned L/yr.	Used Oil Available L/yr.	% of Generated Available L/yr.	Comments
10. NorthwesTel	15,000	Nil	14,000	98	Some burning of used oil at helicopter sites.
11. Bus Lines	15,700	Nil	14,800	94	
12. Aviation	16,890	Nil	16,890	100	All available for recycle.
13. Remote Highway Gas Stations	7,700	Nil	Nil	0	Most use the used oil on site for burning with garbage and dust control.
14. Construction	67,090	2,270	12,470	19	Most oil is now burned or buried in the field.
Totals	853,530	330,770	244,480	28.6	

2. Trucking Companies

Eighteen firms were contacted to obtain figures for used oil generated and availability of used oil. At present, some of these companies use used oil in burners (i.e. Northern Kat, Northland and Yukon-Alaska Transport). Yukon-Alaska Transport uses all of their used oil generated plus oil from other sources in their used oil burner. They are the highest generator of oil at 50,000 L/yr.

3. Truck and Heavy Equipment Repair and Leasing

As with the trucking companies, some used oil is burned in heaters with the rest being used for dust control. A high percentage of oil from this sector is available for recycle. Some of the oil is contaminated and some operators are not willing to separate for reuse.

4. Hardrock Mining

Canamax and Curragh Resources were contacted from the hardrock mining industry. Although Canamax has 10,200 L/yr. of used oil available for recycle, it could be logistically difficult to access and, therefore, considered unavailable for recycle at this time. Curragh uses all of their 224,280 L/yr. for heating in burners and for dust control. This is not available for reuse outside the mine at this time. There is a potential for more used oil when other mines open or re-open (i.e. Skukum, United Keno Hill Mines).

5. Placer Mining

There are two main placer districts in the Yukon: Mayo and Dawson City. From discussions with DIAND Placer Mining Section and operators, it was estimated that 400 pieces of equipment operate in the Dawson area which require an average of 30 L per oil change every 250 hours. The average operation is 1200 hr./yr. In the Mayo area, there are 50 active operators. Four pieces of equipment were assumed per operation and 30 L per oil change with 5 changes per season. Although there are other placer operations in the Yukon, the figure presented is considered generous for the entire field of placer mining.

The oil generated is relatively high. However, the availability is considered low at this time. The main problems are access, onsite storage and collection, and the fact that most miners would not be bothered with delivering used oil to a central depot unless there was some financial gain involved. Northern Kat presently collects some oil from placer mining operations as feed stock for their used oil furnace.

This used oil resource could be explored further and has some potential for reuse if good used oil management legislation were in place and if collection and reuse could be shown to be cost effective.

6. Yukon Government

The figure of 68,330 L/yr. was obtained from the Cottrell report because of difficulty in obtaining figures directly from YTG Central Workshop. It is estimated that approximately 25,000 L/yr. is now being consumed in two used oil burners (Whitehorse and Watson Lake), leaving about 43,350 L/yr. available for recycle. Collection of used oil may be impractical in most cases due to the location of grader stations; however, much of it could be used in used oil burners.

7. Federal Government

Fisheries and DIAND generate a relatively small amount of used oil. About 450 L/yr. of the 2,330 L/yr. figure are too contaminated to separate and, therefore, are not available for recycle. The remaining federal government vehicles are serviced at local service stations and their oil and availability is included in other figures.

8. City of Whitehorse

The City of Whitehorse generates about 2,250 L/yr. of used oil, all of which is available at this time for recycle.

9. Yukon Electrical Company and Yukon Energy Corporation

These figures include used oil generation for the entire territory. About 7,500 L/yr. from the Dawson operation is used by Northern Kat in their furnace. About 810 L/yr. from Beaver Creek is collected and used to assist in brush fire burning, etc. This leaves about 2,250 L/yr. available for recycle from Whitehorse, Pelly, Stewart Crossing and Destruction Bay operations.

10. NorthwesTel

About 1,000 L/yr. of used oil at helicopter sites are burned on site. The remaining 14,000 L/yr. are considered to be available at this time for recycle. This figure includes oil from all equipment at the microwave stations and all vehicles at Watson Lake which are serviced at a local garage.

11. Bus Lines

Contacts were made with Watson Lake Bus Lines, Whitehorse Transit System, Diversified Transport and Atlas Tours. Watson Lake uses all their used oil for dust control in their yard.

12. Aviation

All of the aircraft companies contacted indicated a willingness to have their used oil available for recycle. The figures were obtained from surveys of aviation companies in the Yukon.

13. Remote Highway Gas Stations

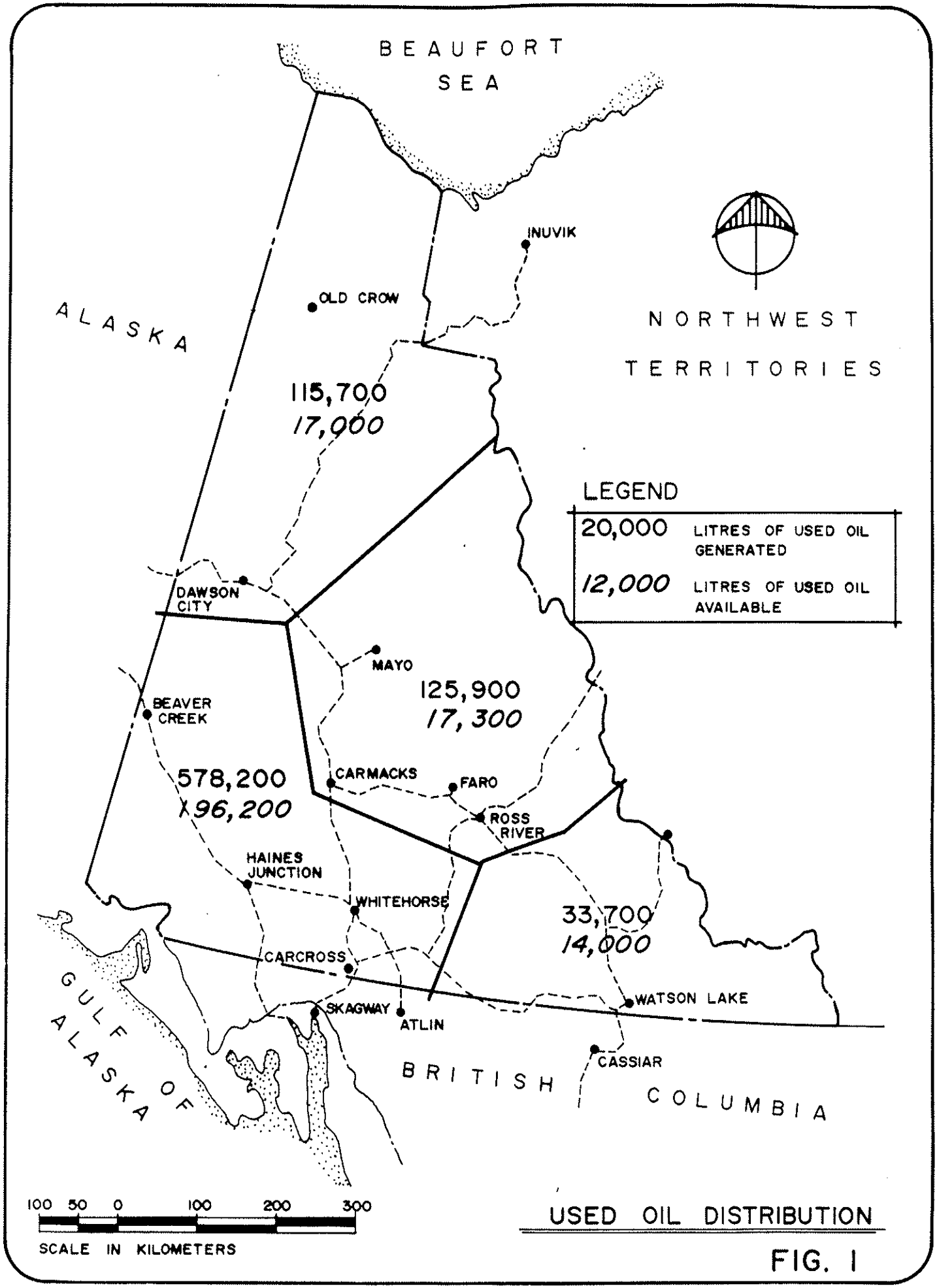
This figure was arrived at by assuming there are 7 lodge/service stations, each generating 909 L/yr. including oil from power plants plus servicing of local and tourist vehicles. Klondike River Lodge is added to this figure at 1,432 L/yr., being a larger operation. Most lodges use the oil on site for dust control or burn it with garbage.

14. Construction

Of all the six larger companies contacted, most indicated they would make their used oil available for recycle. A large percentage of used oil is disposed of in the field, burned or buried. Watson Construction burns about 2,270 L/yr. in their furnace.

Discussion

Estimates of used oil generated and available by region are graphically depicted in Figure 1. From our inventory work in the Yukon, it appears that, of the 853,530 L/yr. of used oil generated, about 28.6% is presently readily available for recycle. The remaining 71.4% is used for various purposes as outlined in the next section and as depicted in Figure 2.



USED OIL DISTRIBUTION

FIG. 1

6.0 PRESENT APPLICATION OF USED OIL

The survey to determine the inventory of used oil disclosed a number of methods for disposing of used oil. Some methods of disposal are performing a useful application for the used oil generator and providing an economic benefit while other methods are simply disposal. Not all methods would be considered environmentally sound.

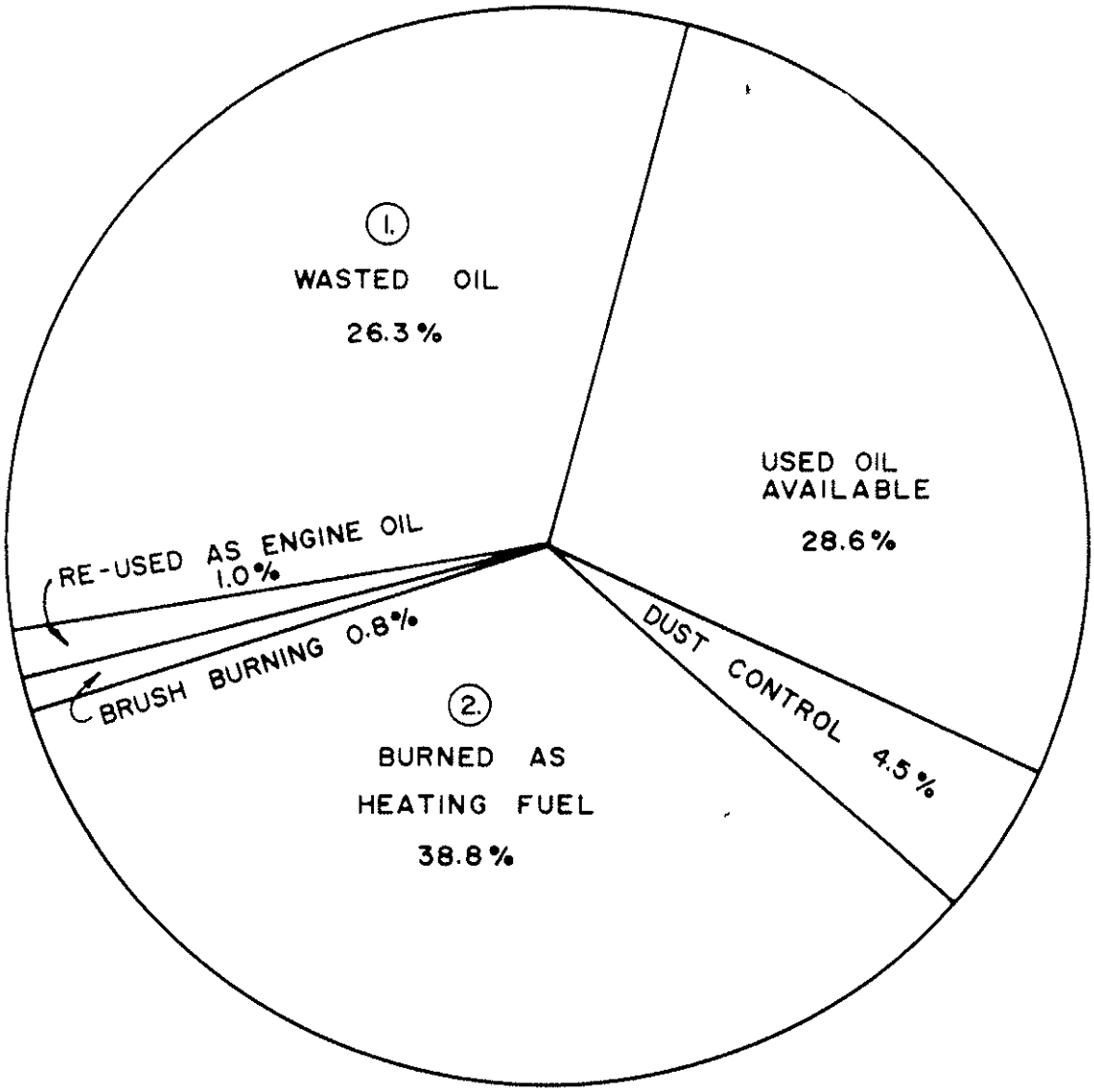
The following disposal methods are being reviewed for their implications on the amount of used oil available for recycling. Figure 2 shows the present estimated breakdown of used oil generated by percentage towards various applications.

6.1 Disposal in Approved Dump Sites

Most communities have a pit for dumping used oil. This oil should be recoverable if the pits are banned by legislation and suitable convenient collection tanks are made available.

6.2 Burned in Used Oil Burning Equipment

This disposal method is based on approved units specifically designed for burning untreated used oil for heating purposes. Most units have been installed for the economic benefit derived from having a very low cost heating fuel. Solving used oil disposal problems are secondary. Unless the present used oil burning equipment is banned for environmental reasons, we expect the quantity of oil presently disposed of in this manner would not be available for recycling in another manner. As requested in the terms of reference of this study, we have estimated the quantity of used oil consumed in this manner to be approximately 38.8% of the total available used oil which includes the small percentage used by homemade used oil burning equipment described in paragraph 6.3. It was reported that White Pass uses used oil as a fuel for the steam locomotive used on the summer tourist trains. We do not know if this used oil is generated in the Yukon or Alaska. This has been assumed to represent an additional 3.1%.



(1.) A PORTION OF THIS OIL COULD BE MADE AVAILABLE WITH A USED OIL MANAGEMENT PROGRAM.

(2.) CURRAGH RESOURCES REPRESENTS A MAJOR PORTION OF THIS PERCENTAGE.

BREAKDOWN OF USED OIL GENERATED

FIG. 2

6.3 Homemade Used Oil Burning Equipment

Our research disclosed that a few resourceful individuals have adapted space heaters, usually some type of solid fuel stove, to burn used oil for heating purposes. It is difficult to determine how widespread this practice is but we estimate the quantity of used oil disposed of in this manner would be less than 5% of the used oil generated. This is an economic benefit to the used oil generator and it is unlikely this oil would be available for recycling in another manner unless legislation banned this practice.

6.4 Dust Control

A quantity of used oil is simply spread and worked into dirt and gravel yards, roads and streets to reduce dust. This practice is not considered environmentally sound. The greatest risk is pollution of water, either surface or ground water, and impact is difficult to predict because of several variables that can affect runoff such as soil conditions, slopes, quantities put down, weather conditions, etc. This practice is banned in some jurisdictions in Canada. There is no legislation in place in the Yukon to control the use of oil for dust control. For some, this practice is a convenient method of disposing of the used oil with a side benefit of dust control. For others, such as small communities, it may have some economic benefit if it reduces use of a water truck, calcium or other methods of dust control. Most of the used oil disposed of in this manner would most likely be available for recycling if use of oil for dust control were banned by legislation. At present, this use represents about 4.5% of the used oil available.

6.5 Lighting Fires for Burning Slash Piles, Garbage, Etc.

Used oil and/or used tires are often used in brush clearing to light the slash piles and, in remote locations, to help burn garbage. The quantity of oil disposed of in this manner is small (approximately 0.8%) and it is unlikely it would be available for recycling.

6.6 Burned in Barrels or Pits

This is a simple, convenient way of disposing of small quantities of used oil, usually in remote locations. Poor combustion would cause some air pollution. Most likely, it would not be economical to pick up the small scattered quantities of oil disposed of in this manner. Education programs and legislation on responsible disposal practices might make some of this oil available for recycling.

6.7 Buried

This is a common practice at remote construction sites where dirt moving equipment is available. It is simple for the contractor to dig a hole for dumping oil during the term of the project and then cover it after the project is completed. There is a risk of polluting water if the location of pits is not carefully chosen. Most of this oil could be recoverable if there were legislation banning this practice.

6.8 Indiscriminate Dumping

This is a practice that is most often used by do-it-yourselfers. It consists of placing containers of used oil in with household garbage or dumping oil in greenbelts or other unauthorized areas. Oil disposal in this manner is environmentally damaging as it can kill vegetation and pollute water as the disposal is often done without regard for the damage it can do. Individually, the disposal areas can be small and scattered but oil disposed of in this manner could represent as much as 20% of the used oil generated in the Yukon. The percentage of this oil that could be recovered for recycling would be dependent on public education, legislation outlining acceptable disposal practices, penalties for improper disposal, convenient collection sites and, possibly, a financial incentive to bring oil to a disposal site.

6.9 Used as an Engine Lubricant in Worn-Out Engines

Clean used oil is put in worn-out engines that have heavy oil consumption so they can be economically operated until they fail, are replaced, rebuilt or taken out of service. This is not a widespread practice and would dispose of only a very small percentage of used oil generated. We expect that this practice will not change in the near future and this used oil would not be available for recycling. This amount is presently estimated to be 1% of the total used oil generated.

Discussion

To improve used oil disposal practices and increase the percentage of used oil available for recycling will require the cooperation of the used oil generators. We expect this cooperation will only be brought about through education, legislation outlining permitted and prohibited disposal practices, penalties or liability for improper disposal practices, and a convenient disposal system.

About 28.3% of the used oil generated is considered to be "wasted", which includes burning in barrels or pits, buried or dumped. This is considered to be potentially available for recycle in one form or another.

7.0 AVAILABILITY OF USED OIL FOR RECYCLING

This survey indicated that about 244,500 L of used oil is presently available for recycling beyond what is presently used for burning as heating fuel (287,630 L) and for other purposes. In addition, there is about 28.3% of used oil generated that is now being wasted in one form or another that could potentially be available for recycle, giving a total of about 60% or 485,642 L per year.

We were unable to carry out a complete survey of the total amount of oil sold in the Yukon per year due to a reluctance on the part of a major supplier to provide such information. However, one petroleum products supplier has carried out an independent market study in this area. They reported a figure of up to 3,000,000 L of lube and hydraulic oil are sold in the Yukon per year. We cannot confirm the reliability of this figure but, if it is accurate, then our figure of 853,500 L/yr. of oil generated is only about 29% of oil sold.

About 50% of new oil purchased is estimated to be lost to engine oil consumption and leaks, etc. Compulsory vehicle inspection regulations will reduce this loss substantially and, under the present system of oil use in the Yukon, one would expect that about 50% should be generated as used oil.

There are two factors that must be kept in mind when studying the amount of used oil available and any programs that are developed for used oil recycling. The first factor is that certain disposal methods have a cost either to the taxpayer in the cost of maintaining disposal sites or the used oil generator in the cost of storing and hauling used oil. The second factor is that the used oil has a value as a resource. Establishing this cost and this value should provide an incentive for optimizing the quantity of used oil recovered.

We recognize that it will require special effort and possibly special legislation to improve the amount of oil recovered. Following are some suggested methods for improving the percentage of used oil recovered.

1. Education:

A public education program is necessary to make people aware of proper disposal practices, the environmental cost of improper disposal practices, and the location of disposal sites.

2. Legislation:

To improve used oil recoveries and develop safe disposal practices, it will be necessary to develop a used oil management plan, legislation that bans certain disposal methods that are environmentally unsound, legislation to make the used oil generator liable for damages resulting from improper disposal practices, and legislation to control environmentally safe methods of disposal. A legislated vehicle inspection program will increase the amount of used oil recovered, improve the quality of the recovered product and improve air quality.

3. Disposal Sites:

To encourage the cooperation of the used oil generator in the recovery of used oil, it will be necessary to establish disposal sites and a collection system. This would be particularly important in helping recover the used oil that is lost in indiscriminate dumping. There is a private enterprise pick-up system already in place for some of the larger used oil generators. To recover the less economically attractive used oil, it may be necessary for the public sector to aid in the collection system. For remote communities, clean used oil could be collected at the garages by a government-operated system.

4. Economical Incentives:

If a refundable deposit were applied to every litre of oil sold, it would establish a value for the used oil for the used oil generator. Since all oil sold would not be recovered, the deposit on this unrecovered oil would provide revenue to help cover the costs of administering a used oil recovery program.

8.0 COLLECTION OF USED OIL

A used oil management plan should have a plan and regulations for collection of used oil. The plan for collection of used oil will be dependent on the goals of the used management plan and will be influenced by the following factors: the cost of disposing of used oil, the cost of recovering used oil, the value of the used oil, and the end use of the recovered used oil. Disposing of used oil has a cost and no value. This would be the cost to develop and manage some type of disposal area and the remediation cost of future environmental damage. Recovery has a cost and a value. There is the cost to set up and manage a collection system which produces a resource that has value. As far as the public is concerned, if the cost of recovery is less than the cost of disposal, it should be considered an economic benefit. Hopefully, the resource will have a value that would cover any costs associated with making it available for reuse. This would include the cost of transportation, processing and profits if it is handled by private enterprise. If it can be marketed at a higher value, the profit should be used to reduce recovery costs. The end use of the used oil will affect both recovery costs and value.

Used oil used by appropriate heating equipment has the lowest recovery cost because this equipment will burn any mixture within reason of used oil products, including contaminated fuel, engine oils, hydraulic oils and heavy gear oils. There would be very little unsuitable material and only one storage container would be required. Used oil burners can be located in the smaller communities to use the used oil produced in the area. The used oil consumer can collect and control the quality of the used oil because they receive the economic benefit. No transfer system or central storage system is necessary. The value of this fuel would be slightly less than the value of the heating oil it replaces because of the higher capital and maintenance costs of this special heating equipment over a conventional furnace.

Small units that refine used oil or recondition used oil for reuse as a fuel for conventional furnaces or diesel engines require a specific standard of used oil stock for processing. This forces tighter controls and higher costs on the collection system and leaves the burden of disposing of unsuitable used oil products. It may also be necessary to separate the various used oil products into separate containers, adding to the cost of the collection system. The refined or reprocessed product would have a value equal to the value of the heating oil or diesel fuel it displaces. For oil to be suitable

for transfer to Turbo Edmonton or Mohawk Vancouver, it must meet their specifications and would require strict control on the collection system. There would be a quantity of unsuitable used oil products that must be disposed of locally.

Both of these alternatives would require the establishment of a collection, transfer and storage system. The collection system recommended in the CCME, Code of Practice for Used Oil Management in Canada would not be practical for the Yukon because the quantities generated are too small and too wide spread (12, p. 17-21). It is unlikely that a private operator would find it economically attractive to establish a district collection, transfer and storage system. Collection storage tanks in most small communities would not have to exceed 3,000 L to store one year's quantity of used oil. The larger communities may require a 10,000 L tank. If quality control is not important, a tank located at a solid waste disposal site would most likely be satisfactory. If quality control is important, the tanks should be located where they can be supervised. This could be at the Yukon Government grader stations, service stations, or at the premises of the greatest used oil producer in the community. The design and location of tanks should be the responsibility of a used oil management program. There are already two firms in Whitehorse that are picking up used oil from some of the larger used oil generators and hauling it to the City of Whitehorse disposal pit. These haulers might be interested in contracts for transporting used oil from the collection tanks to a central storage depot.

A decision would have to be made on the end use for the used oil before the collection system could be planned and a decision would have to be made on whether or not the system should cover its operating costs. If a used management plan introduces strong enough standards with respect to disposal of used oil, a used oil collection system would most likely be developed by the private sector.

The CCME report, Code of Practice for Used Oil Management in Canada, raises concern regarding the transportation of used oil products (12, p. 35). It considers a spill of used oil to be more damaging to the environment than a spill of virgin oil. This report recommends that any regulations for collection, transfer and transportation of used oils should be of higher standards than for handling conventional petroleum products. Although this

report was critical of using used oil burning equipment for disposing of used oil because of the potential for undesirable flue gas emissions, it does say that, for small and remote communities, this alternative is probably the only practical method of disposing of used oil. It is expected all communities in the Yukon except Whitehorse would fall into their definition of small and remote communities. They indicated that local authorities should have some direction in the installation of used oil burners so that the best design and technology is used and the used oil burners are located in an environmentally correct setting.

9.0 RECYCLING OF USED OIL

The terms of reference of this study have mentioned two alternatives for recycling used oil in addition to the present practice of burning used oil for heating purposes. These alternatives will be reviewed for their implications on a used oil management program.

9.1 Transfer to a Used Oil Refinery Outside the Yukon

Ideally, this solution is very appealing as the used oil is recycled to a more useful and valuable product and any pollution or waste products do not affect the Yukon. Practically, at the present time, there are problems with this alternative. We contacted the used oil refineries and found that they can get all the feedstock locally for the cost of picking it up. A new recycling plant proposed for Dawson Creek, B.C. would even charge for accepting the oil.

The report "Yukon Used Oil Disposal Alternatives" indicates that Mohawk in Vancouver would charge 14.3 cents per litre to truck the oil out of the Yukon to their plant. This represents a cost of $5,500 per truck load of 38,600 L. Possibly, this could be reduced to $3,000 per load if it could be hauled as a back haul. Added to this cost would be the cost of operating the local collection system in the Yukon. Depending on the system, this cost could represent as much as 20 cents per litre. If 60% of the used oil generated in the Yukon is collected for re-processing outside the Yukon, the cost per year could be from $143,000 to $179,000.

The market for recycled oil products is soft as there is still consumer reluctance to use recycled oil products and, because crude oil prices are low, there is no opportunity to offer a price advantage for recycled oil over virgin oil. Considering the cost of collection and the cost of transportation, the used oil would have a negative value of 28 to 35 cents per litre.

9.2 Reconditioning or Refining Used Oil Locally

There are at least two units in the developmental stage that will either recondition or refine used oil into a product that can be used as a fuel for furnaces or diesel engines. The product literature indicates that either process would have throughputs that would be compatible with the quantities of used oil generated in the Yukon. The two processes are completely different and deserve some separate discussion.

The **reconditioning process**, in simple terms, is a filtering process that produces a processed used oil that is then combined with either kerosene or diesel fuel to produce a substitute fuel that can be used in a standard oil furnace or a diesel engine. The literature does not indicate if the heavy metals and oil additives that cause concern for direct burning are removed in this process or if the products of combustion would be similar to direct burning.

The **refinery process** consists of a simple refinery that produces a single fraction that is suitable for use as either a heating oil or diesel fuel. This distillate should be an environmentally cleaner fuel than the fuel produced in the reconditioning process. Most undesirable components will be left behind in the undistilled sludge that is produced as a waste product in this process.

The indicated throughput of these units would suggest that at least two units would be required to handle the used oil generated in the Yukon. The refiner also produces heat as a by-product. If the unit were to operate continuously, it would be best located so that the waste heat could also be utilized continuously.

In order to avoid setting up a distribution network for this fuel, it would be best to sell the fuel to a limited number of large consumers such as the diesel generators in Watson Lake or Dawson or some large buildings such as Yukon College or the Government Administration Building. If used oil was processed in the Yukon as a fuel, and assuming a processing and sales cost of 20 cents per litre, and revenue value of 30 cents per litre, the cost for the used oil collection would reduce to $82,000 per year (from the estimated cost to transfer used oil for processing outside the Yukon. See 9.1.)

9.3 Burning Directly in a Used Oil Heating Plant

This alternative consists of using unprocessed used oil as a heat source. It is the most practical alternative, from a cost point of view, for small and remote communities. The collection system can be simpler as there is no need to bring all used oil to central locations for processing. In many areas the consumer can act as the collector. Since there is a wide range of consumption rates available, it is possible to have heating units that have a consumption rate compatible with the local used production rate, particularly in remote

areas where it would not be practical to transport the used oil out. We recognize the concern that the level of undesirable products in the flue gas emissions from used oil burners could be hazardous. We had data on tests of flue gas emissions but we were unable to obtain data on engine exhaust emissions to allow us to compare the emissions from a used oil furnace with the emissions from an engine of comparable fuel consumption. If used as an option for small communities, the burner sites would have to comply with siting criteria and pollution regulations.

Discussion

When advantages and disadvantages are taken into consideration, none of the options has a clear advantage. We discussed the options with Jeff Mach, Chief, Hazardous and Solid Waste Management Section, State of Alaska, to get an indication of how used oil is handled in Alaska. They do not consider establishing a collection and transfer system as an economically viable alternative. This eliminates using central processing systems for treating or refining used oil unless it can be done profitably within a concentrated region. They prefer to have the value of the used oil dictate the extent of the collection and the end use of the used oil. This means that, in a remote community, it would not be economical to haul the used oil out but it would be very worthwhile for an individual to set up a collection system and use the used oil locally for heating purposes. In a larger centre, it may be worthwhile for a large consumer to set up a collection and hauling system. They prefer to legislate the laws, standards and controls for disposal of used oil and let free enterprise develop the solutions.

There is one refining process in Alaska that produces a fuel oil. There are two large consumers using untreated used oil as a fuel. In one case, used oil is mixed with coal and burned in a steam generating plant. In another case, used oil is mixed with wood waste and burned as a heat source for a pulp mill process. Used oil burning heating equipment is commonly used in remote areas. They recognize that there are some undesirable emissions in the flue gases but they feel the emissions produced by the used oil burners are only a fraction of similar emissions produced from all other sources. They would not consider permitting a used oil burner to be located in the middle of a residential subdivision and regulate the location of used oil burning equipment to industrial areas and areas of low population.

A used oil management plan must decide if the used oil is to be an asset or a liability before a decision is made on the method of recycling. At the present time, all used oil would be a liability if it was trucked to refineries outside the Yukon. If all oil was collected and transferred to one or two processing areas within the Yukon, up to fifty percent of the used oil could be a liability because of collection and transfer costs. If the used oil can be consumed near its source, then it would almost all be an asset.

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