MANAGING THE CORPORATE ENVIRONMENT - AN OVERVIEW, R. V. Laughton[1]

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INTRODUCTION

When dealing with any of the issues under the title of "ENVIRONMENTAL CONTROL" it is essential that consideration be given to both the INSIDE plant environment and the OUTSIDE natural environment. In as much as it is necessary to protect our natural resources, it is equally important to protect the working environment. The implementation of either the indoor or outdoor environmental program generally forces the plant manager to deal with the other. For example, to control dust levels inside a plant generally means construction of an air collection, treatment and discharge system. Cleaning up the inside air thus generates a potential for air pollution on the outside environment.

Inside Plant Environment

The requirements for maintaining a safe working environment are as outlined in the "Occupational Health and Safety Act" as amended in 1990. The Act outlines the duties of the employer, supervisor and worker in providing for safe working conditions. Where toxic substances are to be used in the manufacturing process, then controls or restrictions can be defined and set out. The Act outlines the rights of workers to refuse to work under unsafe conditions. Specific safety regulations are further defined for industrial establishments.

Where required, the Occupational Health and Safety Act outlines the procedures for the formation of a JOINT HEALTH AND SAFETY COMMITTEE to share the responsibilities of worker safety. The many details involved in the formation of such a committee is clearly outlined in the document "A GUIDE FOR JOINT HEALTH AND SAFETY COMMITTEES AND REPRESENTATIVES IN THE WORKPLACE".

The most recent modification to inside plant environment control is the introduction of WHMIS, a Canada wide system designed to give employers and employees information about hazardous materials in the work environment. Details on WHMIS are to be presented in a later part of this presentation. An overview on the program is provided in the booklet "WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM (WHMIS): A GUIDE TO THE LEGISLATION".

In the case where "designated substances" are present and a worker is likely to inhale, ingest or absorb some of the substances, it is essential to be up-to-date with the "DESIGNATED SUBSTANCES REGULATIONS". There are individual regulations of each substance, and corresponding guidelines booklets. A general information booklet is available that details the purpose and implementation of the designated substances program. An important part of the regulation is the requirement for a plant assessment, as detailed in Section 2 and as attached. This work can easily be integrated with the overall environmental audit.

Outside Natural Environment

Contaminants resulting from production facilities within the plant site are ultimately discharged to the natural environment in the form of liquid, gaseous, or solid wastes. To control these discharges the Ontario Ministry of Environment and Energy has in place a series of acts and/or regulations.

Of particular interest for the day-to-day operation of facilities are the following:

Environmental Protection Act (EPA)

- control orders
- stop orders
- certificates of approval
- powers of ministers and directors
- spills bill
- reporting requirements

Regulation 346

- air emission restrictions
- under amendment to CAP (Clean Air Program)
- point of impingement versus point of emission
- Source Testing Code for stack sampling

Regulation 347

- handling of liquid industrial and hazardous wastes
- registration required for generation, storage, hauling, disposal
- testing requirements for classification
- leachate testing

Ontario Water Resources Act (OWRA)

- for discharge to aquatic environment
- water taking permits
- general "impairment" conditions

Certificates of Approval

- required under OWRA or EPA
- can't install, contsruct, modify etc., without a certificate of approval
- defines effluent controls
- sets testing requirements
- establishes new costs of applicant

MISA (Municipal Industrial Strategy for Abatement)

- controlling effluent discharges to the aquatic environment
- sector by sector introduction
- involves new municipal sewer use by-law

Specific details on each of these topics are contained in subsequent sections of this presentation.

THE ENVIRONMENTAL STUDY

To obtain a detailed understanding of the plant environment requires an "audit" of the facility. There is considerable confusion amongst the environmental profession itself as to the definition of audits, risk assessments, property evaluations and decommissioning studies.

As a result of an increased awareness of environmental issues, plant audits, risk assessments, property transfer evaluations and site decommissioning are being carried out more often than ever before. Each of these studies involves scientific, engineering and legal and financial concerns and as such, there is a great potential for confusion and misunderstanding.

Plant Audits

A large number of corporations are becoming increasingly concerned with presenting the image of a "good corporate environmental citizen". To this end, the plant audit is a key step in ensuring compliance with federal, provincial and municipal regulation. The step-by-step process includes a preliminary review of background information, followed by identification of areas of concern. Field testing and laboratory analyses are then undertaken to confirm findings, where necessary.

Actual tasks undertaken in the completion of the plant audit include the following:

- investigation of plant sites
- documentation of all processes and contaminant discharges
- review of discharge approvals and permits (Air - Reg. 346, Water - municipal or C of A, liquid industrial and hazardous wastes - Reg. 347)
- summary of files and meetings with Regulatory officials
- modelling of worst case discharges and compliance
- preliminary report
- detailed field testing, where required
- final report

The plant audit is designed to provide a reliable, reasonably-priced evaluation of the environmental status of the facility. The emphasis of the program is on identification of concerns and not implementation of solutions.

Property Transfer Evaluations

Property Transfer Evaluations (PTE's) are becoming an increasingly important step for buyers, sellers, financiers, real estate agents and lawyers involved in real estate transactions. The role of the PTE in these transactions has been a direct result of the increasing concerns regarding environmental liabilities.

A PTE is carried out in order to point out areas of potential liability associated with past or

present waste management practices. The investigation, as a minimum, includes cursory or detailed investigation of buildings, machinery, soils and groundwater. The evaluation provides information to:

- the purchaser who wants to avoid any costly remedial action
- the seller who is interested in a profitable sale and transfer of liabilities
- the financier who is interested in protecting the investment and collateral values of the property
- the agents and lawyers who wish to protect the interests of their clients

In general, the PTE is a step-wise process, the level of detail being governed by the state of the property. The process consists of a background data review, visual inspection, sampling/analysis and preparation of a report. Collecting the background data is the key to establishing past practices - often necessary to developing sampling programs and verification operating permits. Visual inspections often provide evidence of environmental discharges and of establishing paths of waste migration. Sampling and analysis confirms visual inspections or may detect hidden problems.

Environmental Risk Assessments

With the increasing concern for environmental protection and the associated cost of pollution abatement and cleanup, a large number of industries wish to evaluate the environmental consequences of a new or expanded operation prior to start-up. Unlike the "environmental audit" which establishes existing conditions, the "risk assessment" evaluates planned processes prior to implementation. This enables the client to allocate costs to the manufacturing process and assess the risks of any environmental liability.

Environmental risk assessments generally involve input from several categories. For example, a new facility may be planned to increase plant capacity. The risk assessment should then include:

- evaluation of increased hydraulic and contaminant loads to the sanitary sewer system (must be permitted)
- atmospheric emissions which could impact on worker health and safety, or ambient discharges regulated by the MOEE (Reg. 346)
- control of chemicals used in the process, as per WHMIS protocols
- waste liquids and solids disposal as controlled by Regulation 347 or equivalent

In all evaluations, whether it be a unit operation or new facility, attention must be paid to the need for the change, what controls can be used to minimize costs (i.e., product recovery) and what residual risks remain. This information can then be used by management in the evaluation of the project. Specification of control technologies allows for establishment of an "environmental cost" to the project.

Decommissioning Studies

The Ontario Ministry of Environment and Energy has recently developed guidelines for the decommissioning of industrial properties in Ontario, revised 1996.

The tasks required to complete a decommissioning study are summarized as follows:

- preparation and dissemination of a corporate commitment statement
- development of decommissioning program for review by MOEE
- completion of preliminary inventory of plan area and natural environment
- establishment of clean-up criteria, including handling and disposal of contaminants and target levels for residuals
- detailed site assessment and modification as required
- verification by regulatory officials

Dealing With Regulatory Officials

Key to the success of any environmental control program is the establishment of a proper communications channel with the appropriate regulatory officials. The main parties will be:

- Ontario Ministry of Labour
- Ontario Ministry of Environment and Energy
    - District Office
    - Regional Office
    - Approvals Branch
    - Investigation & Enforcement Branch
- Regional Municipalities, Cities and Towns

There is no doubt that the attitude of the regulatory officials has changed over the past few years from that of "working together" to " investigation and enforcement", thus it is more difficult to establish a good working relationship. It has been our experience that the industry that portrays the image of a "good corporate environmental citizen" will benefit in the long run. A key element to establishing this image is liaison with the abatement officers within the various agencies. For example, establishing a working relationship with the District Abatement Officer of the MOEE and the Industrial Waste Inspector of the municipality, can result in development of a control program that does not involve staff from investigation and enforcement. Failure to work with the abatement group, resulting in a visit from the enforcement branch, generally results in control order being issued.

If control orders or stop orders are issued there is generally a notification period during which time a program can be negotiated. Use this period to work out a viable control program such that the order is no longer required.

During the early stages of any new plant or plant expansion, work with the regulatory officials. Keep them up to date on your plans and be sure to file for all certificates and permits required. Don't forget the following:

- municipal sewer use connect permits
- Reg. 346 generator registration requirements (liquid industrial and hazardous waste)
- Reg. 347 air discharge approvals
- OWRA Certificate of Approval

To facilitate compliance with the various acts and regulations we have prepared an overview of the key pieces of legislation dealing with air pollution control, hazardous wastes, Misa and

sewer use, and WHMIS. As a final step we have included insight on spills and control strategies to deal with these requirements.

AIR POLLUTION CONTROL

Under Part II, Sections 5 to 14, of the Environmental Protection Act, the controls to limit atmospheric discharges are put in place by the Ontario Ministry of Environment and Energy. The specific technical requirements are as laid out in Regulation 346, under that Act. A new "CLEAN AIR PROGRAM" was introduced by the Ontario Ministry of Environment and Energy in December 1987, however it is not expected that the general CAP requirements will be passed into regulation for some time. Two contaminants, namely Vinyl Chloride and Benzene, are currently subject to the new CAP requirements in that they require compliance with new POI (Point of Impingement) concentrations and new state-of-the-art control technology.

Air Pollution Regulations

Under the existing legislation and regulations, a proponent is required to apply for a Certificate of Approval for any system that releases atmospheric discharges. On a technical basis this requires a complete understanding of the process that creates the contaminants, the physical process by which they are released, any pollution control equipment in place, the point of impingement concentrations and the general layout of the building and lot.

The key elements of the Environmental Protection Act that apply to air pollution control are the requirements for the Certificate of Approval, and the ministerial powers in the event that an industry is found operating outside the limits of the certificate or the regulations in general. Section 5 is a direct prohibition that restricts all emissions, other than those related to normal farming operations:

> *6. -(1) No person shall discharge into the natural environment any contaminant, and no person responsible for a source of contaminant shall permit the discharge into the natural environment of any contaminant from the source of the contaminant, in an amount, concentration or level in excess of that prescribed by the regulations.*

To provide for control of any processes that could result in an emission, the Ontario Ministry of Environment and Energy, under Section 9 of the Act, requires that a C of A be applied for prior to any construction or modifications of facilities:

> *9.-(1) No person shall, except under and in accordance with a certificate of approval issued by the Director,*
>
> *(a) construct, alter, extend or replace any plant, structure, equipment, apparatus, mechanism or thing that may discharge or from which may be discharged a contaminant into any part of the natural environment other than water; or*
>
> *(b) alter a process or rate of production with the result that a contaminant may be discharged into any part of the natural environment other than water or the rate or manner of discharge of a contaminant into any part of the natural environment other than water may be altered* .

In the event that the ministry determines that the industry is operating outside the certificate than a Control Order can be issued under Section 7 of the Act, as follows:

> *7.-(1) When the report of a provincial officer contains a finding that a contaminant discharged into the natural environment is a contaminant the use of which is prohibited by the regulations or is being discharged in contravention of section 14 or the regulations, the Director may issue a control order directed to,*
>
> *(a) an owner or previous owner of the source of contaminant*
>
> *(b) a person who is or was in occupation of the source of contaminant; or*
>
> *(c) a person who has or had the charge, management or control of the source of contaminant.*

If an industry continues to operate outside the regulations, or has been found never to have complied with the legislation, then a Stop Order can be enforced under Section 8 of the Act:

> *8.-(1) When the Director, upon reasonable and probable grounds, is of the opinion that a source of contaminant is discharging into the natural environment any contaminant that constitutes, or the amount, concentration or level of which constitutes, an immediate danger to human life, the health of any persons, or to property, the Director may issue a stop order directed to,*
>
> *(a) an owner or previous owner of the source of contaminant*
>
> *(b) a person who is or was in occupation of the source of contaminant; or*
>
> *(c) a person who has or had the charge, management or control of the source of contaminant.*

Generally the implementation of a Stop Order only occurs when the Minister has determined that there is a significant potential for damage to the natural environment and in particular to human health.

The work involved in completing the C of A can be summarized as follows:

- detailed review of plant and property
- familiarization with local weather patterns
- calculation of total emissions
- calculation of control technology efficiency
- dispersion modelling for calculation of POI levels stack sampling for confirmation of contaminant levels where required
- determination of additional control required
- preparation and submission of the C of A

An important point to watch for is that a Certificate of Approval can NOT be applied for, when a facility has already been constructed unless the installation was complted after June 1988. The certificate must be obtained PRIOR to undertaking the work, other wise it becomes a "nullity" in law. This is common occurrence, but not an obstacle that can not be overcome.

Application for Approval

Under the existing Regulation 346 it is necessary to have a good understanding of the building construction from which the emission occurs as well as a thorough knowledge of the surrounding property layout, as this is where the POI maximum is likely to appear. In specific cases an in-depth understanding of the general topography is required where this may create site specific climatic disturbances (ie. valleys, ridges, tall buildings, lakes).

There are various options in the detailed modelling of the air emissions, depending on the layout of the building and property relative to the emission. Under the existing Regulation 346 this assists the modeller in determining which mathematical equations are used to predict Point of Impingement concentrations. It is necessary to clearly identify all property boundaries and air intake sources, such that these can then be related to the point of impingement. Very often inadequate planning has resulted in air intake POI's as a result of air conditioners, air intakes, windows, and doors that fall within the area of maximum POI.

The basic models relate the location of the emission source to the height of nearby buildings, as this can have a significant impact on the POI levels. The three major categories are:

> **A** - The stack height is less than two times the building height and the POI is on or within 5 meters of the building on which the stack is located.
>
> **B** - The stack is less than two times the building height and the POI is greater than 5 meters from the building on which the stack is located.
>
> **C** - The stack is greater than two times the building height.

The Regulation is very clear in the definition of which model relates to which particular case, and provides several schematics to demonstrate the case.

The direction and speed of the prevailing winds dictates the direction of plume movement from the emission source. For this reason it is beneficial to have an understanding of these local weather patterns.

Since the wind direction can be altered significantly by man-made or natural obstacles, it is important to have a true outline of their location. In particular, attention should be paid to valleys, escarpments, tall buildings, and open waterways that can alter the normal wind patterns. When this occurs it may be necessary to go to actual physical modelling of the emission, rather than computer modelling, to determine the POI location.

The standard mathematical models have preselected wind speed and direction. These can and should be altered for each particular evaluation. The newest models are much more sensitive in this regard.

A mass balance of the production operation is required to calculate the total amount of each contaminant emitted from the existing or proposed stack. Where possible this should be confirmed with actual stack gas analysis, or comparison of predicted emission rates with existing facilities with similar production schedules.

The mass balance approach ensures that there is no loss of contaminants by way of under estimation of the emission. A difference between measured and calculated emission rates may also indicate the possibility of fugitive emissions, which must be accounted for in the evaluation. In addition to mass rates it is also important to know air flow rates and stack diameters such that the emission rate can be calculated relative to the stack velocity. These numbers are required in for the mathematical models.

Where air pollution control equipment is used to reduce the emission rates it is necessary to document the equipment proposed and make allowance for equipment failure (ie. ripped bag in baghouse). Actual stack testing on an existing or similar air pollution control system can be very beneficial in the documentation of the contaminant recovery. Be wary of supplier's reported capture efficiencies.

At a specified date after the start-up of the facility, the Ministry of Environment and Energy will likely require a stack test to determine the actual versus projected contaminant recovery. With the proposed new Clean Air Program, the requirement for stacks sampling will increase. It is important, therefore, to have a good knowledge of the control technology proposed and the corresponding contaminant recovery rates, to ensure the design is adequate.

There are a number of variations in the computer models used to calculate the POI levels for the Certificate of Approval application. Printouts from the existing REG 346 models are provided in the attachments, along with printouts from the new computer models proposed to be used in modified regulations.

The computer models can be very useful prior to final design to assist in the calculation of required velocities, stack diameters, stack heights, pollution control design and ground level concentrations. In the new regulations it will also be necessary to calculate the additional loading from any one source on the exiting background concentrations. This would be as found in highly industrialized areas, such as Hamilton and Sarnia.

The major differences between the old and the new computer models are:

- the old models are based on equations of Pasquill and Gifford from the early 1960's, and are thus some 30+ years old,
- the new models are based on state-of-the-art equations developed in the 1980's and therefore provide better predictions,
- the new models can look at maximum calculations over any averaging period (year to year), and
- the old models give only instantaneous maximum with no averaging.

The old models provide :

- maximum ground level concentration
- concentration at points model
- multisource available

The new models provide :

- worst case model (simple to use)

- lakeshore model (simple to use)
- GAS model (complex to use) and it requires 1 year of meterological data and source inventory data as input

The modelling can become quite complex in instances where there are multiple emission points. In several industrial complexes we have found literally hundreds of stacks all venting the same operation. It is then necessary to model for multiple point emissions, or to calculate the individual emission and total them on the POI grid. The newer models are more advanced in how they deal with multiple emission points.

Since the new "intent" of the CAP guidelines will eventually be translated into new legislation we strongly advise the review of emission sources with both the new and old models. This ensures that the proponent is aware of any discrepancies that would result in a new or modified facility being acceptable under the old regulations, but not acceptable under the new regulations. This can assist in the budgeting for future modifications, if required. (Note: it is unlikely that the CAP guidelines themselves will be implemented).

Stack Sampling for Design or Compliance

Where required for design purposes, input to computer models or follow-up regulatory compliance, the process of stack sampling can be used to calculate actual versus assumed emission rates. For the Province of Ontario the stack sampling procedure is very rigid and is outlined in details in the SOURCE TESTING CODE. This code describes sampling protocols, report format, and analytical methods for the stack sampling program. Where a specific protocol is not available for a particular contaminant, then the sampling crew is required to clear the test with the MOEE prior to the tests. Several standard protocols are reported in the literature for most conventional contaminants. On numerous occasions the analytical requirements can be adopted from U.S. EPA procedures.

The stack sampling crew is generally well trained, either through attendance at the Windsor Stack Sampling Course, or through several years experience with a certified crew chief. In most instances the crew chief will be a Registered Professional Engineer under the APEO or equivalent. Currently, there are two levels of stack sampling training available through the Windsor program.

Some industries have sufficient stack sampling requirements that they can maintain a complete sampling rig and crew of staff. In general practice, however, a consultant is retained to carry out the stack sampling, follow-up analyses, computer modelling and report submission. The Source Testing Code is very specific about the content of stack sampling reports.

The stack sampling is carried out isokinetically for any gaseous streams that contain particulate matter. This ensures that the sampling procedure does not selectively sample more particulate, or conversely miss particulate, due to the vacuum effect. Isokinetic sampling basically means that the gas is sampled at the same velocity as it travels in the stack. For this reason velocity profiles are completed across the stack prior to the tests. Where only gaseous matter is present it is not necessary to sample isokinetically, thereby significantly reducing the complexity of the test.

Three stack tests are completed for each stack. The test must achieve a preset level of isokinecity to be valid.

Follow-up analysis may be as simple as suspended particulate or complex such as when trace organics or odours are measured. Specific problems can occur when contaminants such as cyanide are under investigation and the odour panel must confirm threshold odour numbers.

The Certificate Of Approval

The actual application for a certificate of approval under the regulations is not complex. A copy of the standard form is attached which shows the major queries. These deal with the location of the industry, the production process, expected emissions, control technology and costs. Generally, the application is supported by a technical design document that details the results of all the testing, whether they be typical test results or site specific test results.

Each of the contaminants must be shown to have a POI level less than that provided for in the regulation. Note that there are a number of unique limits, such as that for fluoride where the allowed POI is seasonally dependant. As noted previously, the new CAP regulations are now being administered for vinyl chloride and benzene.

With the introduction of the new regulations, the certificates will no longer regulate the emission on the basis of point of impingement levels, but rather on the basis of "in stack" levels or ambient air levels. Where there is concern with ambient air levels the regulation allows for stricter control within the stack than for an identical emission in an area where the background air quality is not of concern. It is intended that the new limits will be based on control at the source using BACT-EA, or "Best Available Control Technology - Economically Achievable". This is a similar practice to that which is being enforced under the MISA program, which controls industrial liquid effluents.

Once the certificate has been issued the proponent may then undertake the necessary work to construct the facility or modify the operation, but only as outlined in the certificate. Any deviations from the plans or processes as outlined in the certificate would represent non-compliance with the certificate. It is common for the MOEE to require compliance testing for some 6 months after start-up of the facility to ensure that emission levels are being reached. If they are not, the MOEE can ask for additional modifications or changes in production levels to drop within the regulation. It is important to plan for the compliance test to ensure that production capacity is at the required level for the certificate of approval issued.

WASTE DISPOSAL

Waste disposal practices in Ontario are governed by the Ministry of Environment and Energy. The relevant legislation is Regulation 347 under the Environment Protection Act. This section of the presention will address the following topics:

- An introduction to the Regulation 347 flowsheet.
- How to complete a Generator Registration Report.
- How to complete a Waste Manifest
- Analytical Testing of Wastes

- Where can wastes go?

Waste Disposal Regulations

A simple flowsheet was developed to assist generators in classification of their wastes under Regulation 347. The flowsheet is very user friendly and consists of a series of questions concerning the hazardous nature of the waste.

After the MOEE receives the application, they will review it and issue a Schedule A document to you which will list the wastes you have registered and your generator registration number.

Your are responsible for filling out the application correctly and you are liable for incorrect information.

The registration is only required once for each waste and is site specific. If you move, you must re-register and get a new generator number.

Completing a Manifest

Under Regulation 347, there are provisions for a waybill or manifest system. This manifest system provides a means for:

- the MOEE to monitor waste transfers;
- the Generator to ensure that wastes are received at legitimate sites

Under this manifest system, a form or manifest must be filled out for each waste transferred. The information required on the form includes:

- Part A - Generator Information
- Part B - Carrier Information
- Part C - Receiver Information

The manifest is available only to approved carriers who may obtain it from the regional or district office of the MOEE, where the carrier is located.

For wastes transferred within Ontario, the carrier completes Part B of the manifest and gives the form to the generator. The generator in turn fills out part A of the manifest and takes the white and green copies (copy 1 and 2). Copy 1 (white) is sent to the MOEE within 30 days and Copy 2 (green) is retained by the generator for at least two years. The remaining four copies are taken by the carrier to the receiver. The receiver fills out part C of the manifest and gives Copy 4 (pink) back to the carrier who must retain it for two years. The receiver then sends Copy 3 (yellow) to the MOEE and Copy 5 (blue) for two years.

If, for any reason, the receiver refuses the load, the generator is responsible for re-accepting the waste and the generator acts as the receiver with regards to filling out the manifest.

For transportation of wastes outside of Ontario or from other parts of Canada to Ontario, a similar manifest under the Transportation of Dangerous Goods Act is filled out.

Analytical Testing

When following through the Waste Identification Flowsheet, you may come across several questions for which you have no answer, such as:

- Is the waste Ignitable, Corrosive or Reactive?
- Does the waste generate contaminants at concentrations greater than 100 times Schedule 4 concentrations?
- Does the waste generate leachate contaminants between 10 and 100 times Schedule 4 concentrations?

In order to answer these questions, one generally has to have a sample for the waste tested by a laboratory.

If the waste has a flash point less than 61C, it is classified as ignitable (e.g., ethanol, varsol, gasoline, paint thinner, charcoal, methane, butane, propane). Flash point is the temperature at which the vapours over the sample ignite when a source of ignition is present.

Corrosive wastes are defined as liquid with a pH < 2.0 or > 12.5. A single pH measurement can determine if the waste is corrosive or not.

In order to determine if a waste is leachate toxic, a leachate extractions procedure must be performed on the liquid or solid waste. The extraction is carried out by shaking the sample in an aqueous solution at pH 5.0 for 24 hours. The sample is then allowed to settle out and the liquid on the top of the sample is filtered and analyzed for contaminant listed on Schedule 4.

If the concentration of any of these contaminants is greater than 100 times the concentration on Schedule 4, the waste is classified as "Leachate Toxic" and must be registered if the concentration is between 10 and 100 times the schedule 4 concentration, the waste must be registered; however, it is not subject to the same disposal requirements as Hazardous Wastes.

The last general test which is often required is the slump test. This test is used to determine if a waste is a solid or a liquid. The test apparatus is a metal cone which is 300 mm high, has a base diameter of 200 mm and a top diameter of 100 mm. The cone is filled with the test material which is tamped down to fill the mold completely. The mold is then removed and the degree of slumping is measured. If the material slumps more than 150 mm, it is classified as a liquid. This test isn't always applicable. If the waste is very dry and loose, it will just fall apart. It is really only used for pastes and sludges, or where it is not obvious if it is a liquid or a solid.

Ultimate Disposal

The ultimate receiver of the waste depends on the physical state of the waste and how hazardous the waste is.

Solid wastes which are non-hazardous such as Registrable Solid Wastes, can go to a municipal or private landfill site as long as they will accept them. These landfills are usually licensed to accept only certain types of waste.

If the waste is hazardous, it must go to a secure landfill such as the Laidlaw (formerly Tricil) site in Sarnia. Solid wastes can also often be sent to a suitable recycling facility.

If the waste is a liquid, there are several options available. The first avenue to investigate is recycling. This is very common practice for solvents. Through distillation, the solvents are purified and can be reused. If you have a waste and you want to know if it can be recycled, call the Ontario Waste Exchange (416) 822-4111, Ext. 358.
If the waste is non-recyclable, it can often be treated or stabilized to make it less hazardous. This could involve solidification, precipitation or other processes.

Incineration is a third option. Waste oils are often sent to the Laidlaw incinerator in Sarnia. This facility will accept oils with less than 2% chlorination. If the degree of chlorination is greater than 2%, they are often sent to the U.S.A. for incineration in a rotary kiln. This cost of this special treatment can be five times the regular price. This is something to consider when purchasing or disposing of oils.

MISA AND SEWER USE BY-LAWS

MISA, the Municipal/Industrial Strategy for Abatement, is an Ontario Ministry of Environment and Energy program intended to bring about the virtual elimination of toxic discharges to Ontario waterways. In this section we will discuss the legislation and timetable, the requirements for sampling and analysis, and the link between MISA and the current sewer use by-laws.

Misa Regulations

The current MISA legislation is now being applied to those industries discharging effluent directly into waterways. To facilitate implementation of the legislation, those industries have been divided into eight sectors. Municipal sewage treatment plants are included in a ninth sector. Regulations are being phased in sector by sector. Industries discharging into sewer systems will be regulated by the municipalities themselves, using a modified sewer use by-law.

The MISA legislation requires that each industry monitor the flows and concentration of a selected series of priority pollutants in their effluents for a period of one year. On the basis of the results of the monitoring period, an abatement regulation will be developed with the goal of reducing the concentrations and amounts of toxic substances that may be discharged. These limits may be periodically tightened as technology improves or if the receiving waterway continues to be seriously damaged.

The analytical parameters generally include about 180 priority pollutants divided into about 30 analytical test groups. These include conventional parameters (such as COD, pH, ammonia, TOC), metals, volatile organics and extractable organics. In addition, periodic open scans are required to allow characterization of components that may be present in the waste, but are not on the initial target list. A toxicity test is also required periodically. The tests required, the frequency of testing and the effluents to be sampled are determined by the MOEE for each industry. These requirements are outlined in the MISA regulation for that sector. Following each round for testing, the results are submitted to the MOEE in electronic format.

Through the mechanism described above, the direct discharging industries deal directly with agents of the MOEE. Industries discharging into the municipal sewers will be regulated by a different mechanism. This occurs because it has traditionally been the municipalities' role to regulate sewer discharges.

The MISA approach to this sector will be to strengthen the existing sewer use by-laws by proposing that each municipality adopt the MOEE Model Sewer Use By-law. This model will include general controls on toxic substances and will provide additional monitoring, inspection and enforcement tools. Following this, more stringent controls, similar to those presently required for direct dischargers,will be implemented through amendments to the by-law. The municipalities will retain responsibility for ensuring compliance with the by-law.

Plant Audit and Treatment Options

As discussed previously, the "Plant Audit" is the first step in determining what loadings are going to the sewer, how can this be reduced by materials recovery, and what is left over that requires treatment.

The most critical stage in determining waste treatment requirements for a particular industry is to determine the group of processes that should be utilized to treat the waste to the necessary effluent standards. The three major classes of treatment that can be considered are as follows:

- physical treatment
- chemical treatment
- biological treatment

Generally physical treatment is utilized where the contaminants are in a solid form and they can be filtered out of the waste. The degree to which filtration is useful depends highly on the size of the particulate that must be filtered out for the waste. The sophistication of physical treatment can range from simple sand filters to very complex ultrafiltration or reverse osmosis systems.

Chemical treatment can be utilized as a support process in the physical treatment stage, where chemical coagulation and flocculation are required to remove colloidal particles. Chemical treatment can also be considered independently where chemical oxidation is necessary to break down soluble organics. For example, chlorine oxidation, ozonation or treatment with other chemicals such as potassium permanganate and hydrogen peroxide can reduce large chain organics to smaller less harmful compounds. There are also a large number of less commonly used chemical treatments ranging anywhere from high pressure wet air oxidation to electrodialysis.

The third type of treatment, which is one of the most common types of industrial waste treatment for soluble organics is biological treatment. Quite frequently biological treatment is also used in conjunction with physical treatment and/or chemical treatment. A typical example would be a waste stream could be settled to remove gross solids, biologically treated to remove the majority of the soluble organic carbon compounds, ozonated to remove residual trace organic contaminants and then filtered to remove trace suspended solids.

WHMIS - WORKPLACE MATERIALS INFORMATION SYSTEM

WHMIS, the Workplace Hazardous Materials Information System, came into effect on October 31, 1988. WHMIS is a national system to identify workplace hazardous materials and provide safety information about them. The WHMIS program deems any product to be hazardous if it falls into any of the following categories: Compressed Gases, Flammable and Combustible Material, Oxidizing Materials, Poisonous or Infectious Materials, Corrosive Materials, and Dangerously Reactive Materials. Some products, such as consumer products, are exempt from the legislation.

Implementation of the WHMIS program requires action in five areas. These are:

1) An inventory of hazardous materials in the workplace must be carried out;

2) A uniform labelling program for hazardous materials must be implemented;

3) Material Safety Data Sheets must be available to the workers;

4) A worker training program must be carried out;

5) A list of the hazardous materials used on-site must be disclosed to the medical Officer of Health and to members of the general public if requested.

The major responsibility for implementing and complying with WHMIS lies with the supplier of hazardous materials and the employer. These responsibilities will be discussed in this section.

The supplier must ensure that supplier WHMIS labels and safety data sheets are included with the product as it leaves their premises.

As it is the employer's responsibility to ensure that such labels and data sheets are available and in place, the labelling and MSDS requirements under WHMIS will be reviewed.

A major responsibility of the employer under WHMIS is the provision of a worker training program outlining the interpretation of labels and safety data sheets as well as providing chemical-specific safety training. The content and implementation of such a worker training program will be discussed.

Several agencies offer help in the implementation of the WHMIS program in the workplace.

The hazardous materials that are covered by WHMIS include compressed gases, flammable and combustible material, oxidizing materials, poisonous and infectious materials, corrosive materials, and dangerously reactive materials.

The exemptions from the WHMIS list include hazardous wastes, cosmetics devices or food, explosives, consumer products, pesticides, radioactive materials, wood or wood products, tobacco or tobacco products, and any manufactured article.

The five (5) components of the WHMIS program that must be initiated by the company, include:

1) Inventory of Chemicals

2) Product Labelling

3) Data Sheets (MSDS's)

4) Worker Training

5) Disclosure of Ingredients

Each employer is responsible under the WHMIS program to:

1) Inventory hazardous products

2) Ensure that labels and MSDS are available and in place (implement system to ensure compliance)

3) Implement worker training program

The key responsibilities of the supplier under WHMIS are;

1) Must provide supplier label and MSDS for each product

2) Must ensure that they are shipped with the product

Each material safety data sheet (MSDS) must include the following information:

1) Hazardous Ingredients

2) Preparation Information

3) Product Information

4) Physical Data

5) Fire or Explosion Data

6) Reactivity Data

7) Toxicology Properties

8) Preventive Measures

9) First Aid Measures

The WHMIS worker training programs must include:

1) WHMIS overview:
    - legislation
    - WHMIS regulations
2) Labelling program

3) Material Safety Data Sheets

4) Chemical Hazards and Safety
    - health effects of hazardous materials
    - physical data, fire/explosion hazard, reactivity data
    - safe work procedures and control measures
    - handling, use, storage, disposal

5) Evaluation

SPILLS RESPONSE PLAN

In preparing a "Spills Response Plan", there are a number of standard procedures for detection, control and clean-up of spills. In addition, but often forgotten, is the need for an adequate spills planning or response relating to the monitoring and assessment of the spill. This program must be in place so as to provide monitoring before and after any occurrence.

There are several areas within Part X of the Environmental Protection Act (The Spills Bill) that can involve sampling and analysis for "pollutants". Under the Act the pollutant is described as "a contaminant other than heat, sound, vibration or radiation, and includes any substance from which a pollutant is derived". By this definition, a pollutant can then be in the form of a liquid, gas or solid, thus monitoring and assessment must be structured to deal with all three forms.

Whether a spill has occurred or not is a question as to whether there has been a "pollutant" spilled and whether this has caused an "adverse effect". In general terms an adverse effect has been defined as a conditions where the spill:

- causes or is likely to cause impairment of the quality of the natural environment for any use that can be made of it;
- causes or is likely to cause injury or damage to property or to plant or animal life;
- causes or is likely to cause harm or material discomfort to any person;
- adversely affects or is likely to adversely affect the health of any person;
- impairs or is likely to impair the safety of any person;
- renders or is likely to render any property or plant or animal life unfit for use by man;
- causes or is likely to cause loss of enjoyment of normal use of property; or
- interferes or is likely to interfere with the normal conduct of business.

Monitoring and assessment to determine whether a spill has actually occurred can therefore be an important issue for follow-up claims and/or judicial action.

Monitoring and assessments also required once a spill has occurred to assist in the

determination of the following:

- what components make up the spill
- how dangerous is the spill
- how far has the spill travelled
- what damage has been caused by the spill
- what remedial action is required to alleviate further damage from the spill
- if there has been environmental damage is it long-term or short-term

To properly implement a sampling and monitoring program, action is required immediately. The "Spills Response Team" must have adequate facilities for the collection and preservation of samples and the "Monitoring Team" must be prepared to mobilize quickly. The monitoring and assessment can include analysis by chemical and/or biological procedures, thus samples must be collected accordingly. Stringent Quality Control and Quality Assurance must be utilized throughout.

Monitoring Before the Spill

It is unlikely that any individual would be aware that they were going to have a spill, so how can you monitor before the spill? Our experience has shown that many industries that store or transport materials that if released could cause an "adverse effect", have used pre-monitoring to gain a better understanding of the potential problem and how remedial action could be implemented.

In the simplest form, pre-monitoring should include analysis, or review of analysis, for the specific product or emissions that could cause a spill. This might include characterization of a raw or finished product in storage or under shipment, analysis of contaminant (i.e. leachates) that could arise form a stored solid waste, or projection of worst-case airborne emissions from a combustion system upset.

A combination of chemical or biological analysis, coupled with computer modelling, can assist in projecting he seriousness of a spill.

Often the pre-monitoring for a spill arises out of a program to complete an "Environmental Audit". Knowing what is on a plant site and what damage could arise from an uncontrolled release of that product, is an essential part of the audit. Similarly, knowing the consequences of an uncontrolled release of the product during transport is a key element in the formation of an emergency response plan.

In several situations pre-monitoring has gone further, with monitoring of the surrounding natural environment as well as the potential contaminant. Having familiarity with the plant, plant site, or transportation route is the key to having completed a proper "Environmental Risk Assessment". Such and understanding not only assists in responding to the spill with prompt remedial action program, but also assist in monitoring after the clean-up to determine the effectiveness of the remedial action program.

In specific instances, the pre-monitoring program can assist in the determination of whether the release of material has been a "spill". This can arise from determining whether the component released was a "pollutant" and whether such release had an "adverse effect". We

are involved in a situation now before the courts where this pre-monitoring has lead to a legal challenge as to whether a spill ever occurred or whether there has been an adverse effect. The pre-monitoring has also resulted in significant reductions in fines imposed on corporations as the result of a spill, where a reduced adverse effect has been shown as a result of corporate action. This is only possible when the monitoring and assessment has been carried our prior to and immediately after the spill.

Monitoring After the Spill

Immediate response is required at the time of the spill to assess the extent of the spill, determine the potential adverse effects, and to assist in planning remedial action.

In most instances the "Spills Response Team" is equipped for sample collection and some on-site analysis. For example, having the ability to determine whether a spill is an acid, a base, ignitable, oxygen displacing, or toxic, can greatly assist in protecting the clean-up crew, responding immediately with neutralizing agents, formation of evacuation plans and notification to other parties as to additional clean-up requirements.

Samples should be collected at the site of the spill, of both the pollutant released at the site and the receiving body (stream, air, soil). The Spills Response Team must be aware of sampling protocols to ensure that the samples collected will be suitable for subsequent analysis. Standard procures are described in the literature for the collection and storage of a wide variety of contaminants.

Monitoring after the spill can also involve "long-term" monitoring to assess the extent of the spill or the effect of the remedial action. For example, a spill to a stream can be evaluated on the short-term with organic and/or inorganic analysis, but a long-term assessment may include biological monitoring for:

- changes in the benthic community (bottom dwellers)
- bioaccumulation in aquatic organisms (fish, clams)
- residual toxicity (fish, daphnia)
- contamination of food resources

Long-term biological monitoring is most beneficial where pre-monitoring data is available. This is because it is more often the "change" in the biological community that is the important issue, rather than the instantaneous measurement.

Sampling Protocols

Sampling that should be conducted by the Spill Response Team should consist of the following:

- a natural flora/fauna samples obtained by collecting and tagging biological samples from within the boundaries of the spill site;
- surface water samples which are collected in containers specifically prepared in the laboratory for trace organic and trace metal analysis, with separate samples for volatile organics (no headspace), base neutral and acid extractable organics (no preservative), metals (glass containers with acid), and solvent extractable (glass);

- soil samples obtained from creek beds, shovel holes and back hole excavations which are placed in tagged plastic bags;
- ground water samples taken of any runoff water which flowed into excavations.

Additional sampling to be completed in the follow-up detailed programs would consist of:

- non-intrusive geotechnical testing, if a significant portion of the spill was suspected of percolating into the soil
- surface soil sampling, where it is necessary to define the extent of the contaminated area
- sub-soil and groundwater drilling, if non-intrusive testing indicated major sub-surface contamination
- surface water collection, where contamination of nearby water courses has occurred
- biological sampling, in the event there is an impact on the flora/fauna from the spill

All sampling and analysis should be competed in accordance with "Standard Methods for the Examination of Water and Wastewater", in conjunction with proposed procedures for on-site sampling as detailed by the United States EPA for superfund sites and the Ontario MOEE protocols for MISA program.

Samples collected in the field should be subjected to the required clean-up and preservations, immediately upon receipt in the laboratory. A split of all samples, or duplicate samples where protocol dictates, must be maintained in the laboratory cold storage facility. Standard procedures must be implemented to log all samples, trace all samples forwarded to sub-contract laboratories, recording of analysis on computer, and reporting of results.

For any samples submitted to outside laboratories a standard sample description document must be provided. This document must outline target compounds for mandatory testing, minimum detection limits required, QC/QA procedures to be followed, reporting of results and return of samples or extracts.

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