NOVA SCOTIA
Transportation and Active Transit

Use of Liquid Anti-stripping Asphalt Additives on NSTAT Projects 2021 Action Plan

1. Introduction

"Stripping" of asphalt pavement is a failure of the bond between the asphalt binder and the aggregate which allows the surface of the paved road to deteriorate by having individual pieces of aggregate break free leading to a general erosion of the surface over the affected area. Laboratory tests have been developed to help identify asphalt pavement mixes that are susceptible to stripping. There are a number of options possible when a pavement mix is identified by the laboratory as having failed the stripping tests.

One option is to change the composition of the asphalt pavement mix–particularly by using a different source of aggregate from a quarry that is not prone to stripping and therefore will not need an anti-stripping additive. **This Action Plan does NOT apply to asphalt pavement mix which has no anti-stripping additive.**

Another option is to modify the mix by the addition of hydrated lime. Special safety procedures will be necessary with hydrated lime because the dust can easily become airborne and is a severe irritant to the eyes and mucous membranes. **This Action Plan does NOT cover the precautions necessary for the use of hydrated lime.**

There are also a growing number of asphalt additives that are not used for anti-stripping purposes, but may be added for other reasons. This is particularly true for warm mix formulations. Precautions not included in this plan may be required for these additives. **This Action Plan applies ONLY to asphalt additives that are used as anti-stripping agents.**

This Action Plan APPLIES to liquid anti-stripping asphalt additives which are added to the liquid asphalt binder to modify its binding properties and keep it firmly adherent to the aggregate, thus preventing or reducing the stripping problem.

Only liquid anti-stripping asphalt additives which have passed the NSTAT toxicological and health criteria for inclusion on the List of "Acceptable" Anti-stripping Asphalt Hot Mix and Warm Mix Additives for 2021 NSTAT Projects are permitted to be used on NSTAT paving projects.

For the purposes of this Action Plan, liquid anti-stripping additives are separated into two categories–those based on reactive amine chemistry and those based on other chemical properties.

Sections 2-12 and 18 and 19 of this Action Plan apply to ALL liquid anti-stripping asphalt additives, including those that do not contain active amine compounds.

Sections 13-17 of this Action Plan apply ONLY to liquid anti-stripping asphalt additives that are based on reactive amine chemistry.

These sections include information about additional requirements that relate to the use of amine-based additives that have passed the NSTAT toxicological and health criteria for inclusion on the List of "Acceptable Anti-stripping Asphalt Hot Mix and Warm Mix Additives for 2021 NSTAT Projects.

2. List of "Acceptable" Anti-stripping Asphalt Hot Mix and Warm Mix Additives for 2021 NSTAT Projects

The products on this list have been subjected to an internal Occupational Health and Safety Review by NSTAT respecting formulation and the toxicology of ingredients and have been determined to meet departmental criteria for use on 2021 paving projects. Inclusion on this list indicates that the product has been reviewed with respect to potential health effects on workers who may be exposed to it during asphalt hot or warm mix plant, spreading and compacting operations. Their use is governed by this 2021 Action Plan.

Product	Supplier	Maximum * Concentration
Additives that do NOT contain active amine compounds:		
Latex emulsion or polymeric treatment		
Ultracote	Ultrapave (Textile Rubber and Chemical Co. Affiliate)	
Organosilane compounds		
Zycosoil	Zydex	0.5%
ZycoTherm SP	Zydex	0.5%
Phosphate compounds		
Evotherm P25	Ingevity	0.5%
NovaGrip 975	Arkema/Arr-Maz – Road Science Division	0.5%
NovaGrip 1212	Arkema/Arr-Maz – Road Science Division	0.5%
Wetfix G400	Nouryon	0.5%
Additives that DO contain active amine compounds:		
AD-here LOF 65-00	Arkema/Arr-Maz - Road Science Division	0.5%
Evotherm M1	Ingevity	0.5%
Pave Bond Lite	Ingevity, Distributed by Brenntag	1.0%

* Maximum concentration of liquid anti-stripping asphalt additive in hot liquid asphalt cement, as delivered to the hot or warm mix plant. Addition at the asphalt plant is not allowed.

Please note that inclusion on this list does not mean that there will be no adverse effects associated with the use of the product, especially for amine based anti-stripping additives. Worker exposure should be reduced as much as possible by careful consideration of site location, prevailing winds, moisture control, engineering controls, and other factors which can be controlled.

For amine-based products, more sensitive workers may experience some irritation of mucous membranes (especially mouth and upper respiratory tract) and may need to wear respiratory protective equipment. Workers who have been "sensitized" to the amine in these products may need to be removed from further exposure (see Sections 12-18 of this Action Plan.

3. Background

Before 1994, liquid anti-stripping (LAS) asphalt additives were not used on Nova Scotia government highway paving projects. The department was then known as Nova Scotia Transportation and Communications. In 1996 the name changed to Nova Scotia Transportation and Public Works, and in 2007 changed to Nova Scotia Transportation and Infrastructure Renewal and in 2021 to the present name of Nova Scotia Transportation and Active Transit (NSTAT)

In 1994, amine-based LAS additives were used experimentally on three projects to improve the bonding of the liquid asphalt cement to the aggregate in order to prevent a deterioration of the road surface known as “stripping”. On these projects a number of workers experienced severe eye, nose and throat irritation; nausea; vomiting; dizziness and headaches. When progressively aggressive attempts to control these problems with personal protective equipment were unsuccessful, the use of the LAS asphalt additives was discontinued for the remainder of the paving season while solutions were found to the problem of workers experiencing adverse health effects.

Research identified components in the amine-based LAS asphalt additives used in 1994 which were consistent with the health effects experienced by the workers. Alternative products were investigated and a list of “Acceptable” products with reduced health effects was developed for use on future projects. These products were chosen because they had low vapour, low odour, low irritation potential and no long term health effects.

Working with all the stakeholders, including the Department of Labour, the Department of Transportation and Communication also developed an Action Plan to overcome any residual health and safety problems associated with the use of the newer “Acceptable” LAS additives which were based on modified amine chemistry. Further experience with the use of LAS additives has led to improved procedures to eliminate or reduce exposure. This Action Plan deals with much of that detail, and is updated each year to provide the latest information.

Over time, industry research has resulted in new generations of amine-based LAS products which have even fewer and less severe health effects, and some LAS products that are not based on amine chemistry. These newer products have progressively replaced the earlier products. Consequently, the Action Plan has been changed to have different provisions for projects using amine-based products and those which use non-amine based additives.

Changes in paving technology have also resulted in warm mix processes as well as hot mix processes, with new additives associated with the warm mix processes and lower risk for workers on these projects.

4. Nova Scotia Transportation and Active Transit (NSTAT) Contract Specifications

To avoid premature failure of the asphalt pavement surface due to stripping, NSTAT Contract Specifications have been written to require contractors to have their asphalt mix tested using a the Modified Lottman Test and a visual (laboratory) observation of the interior surfaces of artificially aged samples. Contract Specifications give options to contractors where the sample asphalt mix fails the Modified Lottman Test or visual observation.

When a sample asphalt mix fails the laboratory test or visual observation, there is no requirement to use an amine-based liquid anti-stripping asphalt additive. Instead, the contractor may choose to find another source of aggregate which does not strip or to use some other form of anti-stripping additive such as hydrated lime or a liquid anti-stripping asphalt additive that is not amine based.

Using a solution that does not involve an amine-based liquid anti-stripping asphalt additive will eliminate a number of requirements that must be implemented on projects that use amine-based additive.

The Contract Specifications outline requirements to be met if the contractor decides to use an amine-based liquid anti-stripping asphalt additive. They include the requirement for the asphalt spreader (paver) to be equipped with a local exhaust ventilation system to capture and remove airborne vapours. Paving in damp weather conditions may require additional controls and paving in wet conditions is not permitted. Worker information sessions, provision of respiratory protection and relocation of sensitive workers away from further exposure are all covered by the specifications. The department will monitor paving projects where amine-based liquid anti-stripping asphalt additives are used.

5. Review of New Anti-stripping Asphalt Additives

Having recognized the hazards associated with historic liquid anti-stripping asphalt additives, over the 28 years that additives have been used on Nova Scotia paving projects the chemical specialty industry has developed a number of new products. Initially these were principally less toxic amine-based products, some of which met the NSTAT health screening criteria and were added to the list of “Acceptable” LAS additives.

Some were based on other chemistry that did not depend on amine-based chemicals. These were also reviewed for compliance with the NSTAT health screening criteria and several have been approved for use, providing options for contractors wishing to use a non-amine-based liquid anti-stripping asphalt additive.

Over the last half dozen years, there has been a move to more warm mix formulations. Some of these formulations use liquid anti-stripping asphalt additives, and if so they must meet the same health screening criteria as the hot mix additives.

6. Approval of Liquid Anti-stripping Additives

Selection of liquid anti-stripping additives for use on Nova Scotia Transportation and Active Transit projects starts with a review of the health and safety associated with their use, using the following criteria:

A. For All Products

1. Administrative

a. Available for sale in Canada
b. All ingredient and specification information supplied as requested, including information which is regarded as trade secret or confidential business information (under a confidentiality agreement, if necessary)
c. Complete and adequate Safety Data Sheet (SDS), meeting all Canadian Workplace Hazardous Materials Information System (WHMIS 2015) requirements. Where all ingredient information is not fully disclosed (i.e.: listed as trade secret or confidential business information) the SDS must be reviewed by the Hazardous Materials Information Review Agency of Health Canada and must be issued with a Trade Secret Registry Number
d. Sample of the formulation provided

2. Physical Characteristics

a. Non-volatile formulation (no low boiling components)
b. Low odour formulation

3. Toxicological Characteristics

a. No ingredient with long term health effects, such as carcinogenicity, reproductive toxicity or lasting effect on any organ system
b. No ingredient which is a primary lung sensitizing agent
c. Overall formulation must be non-corrosive
d. Overall formulation must be low irritant
e. For formulations using a solvent to "cut" the final formulation, that solvent must be low toxicity

B. For Formulations Containing Amines

In addition to the criteria for approving all anti-stripping asphalt additives listed above, additional criteria are in place for evaluating amine-based formulations:

1. Additional Toxicological Characteristics

a. No low molecular weight amines (e.g.: EDA, DETA, MEA) in final formulation
b. No low molecular weight amines used as raw materials in preparing the formulation unless excess (unreacted amine) raw material is removed from the final formulation
c. No primary amines in the final formulation
d. Preference given to derivatized or substituted amines (e.g.: ethoxylated)

7. Approval of Asphalt Cement Suppliers

Liquid anti-stripping asphalt additives must be added at the refinery or tank farm. They may not be added at the hot or warm mix plant. To ensure that the proper additive in the correct amount is added, each supplier of asphalt cement must submit a quality control program to NSTAT for review and approval. The review ensures that proper equipment and procedures are in place for accurate addition of the liquid additive to the bulk asphalt cement transport tank(s) and that current Safety Data Sheets are available for the anti-stripping product(s) available from that supplier.

In 2021, three suppliers have been approved for NSTAT paving projects:

- Irving Oil Refinery in Saint John, New Brunswick, providing Zycotherm SP;
- McAsphalt in Eastern Passage, Nova Scotia and McAsphalt in Dieppe, New Brunswick, providing Evotherm M1, Zycotherm, Evotherm P25, and AD-here LOF 65-00; and
- General Liquids Canada in Waverly, Nova Scotia, supplying Zycotherm SP, Zycosoil, Evotherm M1 and AD-here LOF 65-00.

8. Cooperation with Concerned Parties

Over the past 27 years, in the development and implementation of the LAS Action Plan, Nova Scotia Transportation and Active Transit has worked closely with internal Joint Occupational Health and Safety Committees, the Nova Scotia Road Builders Association, suppliers of liquid anti-stripping asphalt additives, liquid asphalt cement suppliers (refineries and bulk distributors), hot or warm mix truckers, the Occupational Health and Safety Division of the Nova Scotia Department of Labour and Advanced Education (previously Nova Scotia Environment and Labour), and safety organizations.

9. 2021 Action Plan

Based on the 1994 to 2020 experience, this 2021 Action Plan has been developed. Please note that this version of the plan is current as of the date noted at the bottom of the page. However, the plan is subject to change and NSTAT officials should be consulted to determine whether the plan has since been updated. A new Action Plan is produced each year, and only the Action Plan for the current year should be used. A free copy of the current Action Plan may be obtained using the contact information on the last page of this document.

10. Pre-Construction Meeting

Each NSTAT project using a liquid anti-stripping asphalt additive must have a Pre-Construction Meeting between NSTAT officials and the contractor for that project to review the requirements for use of the additive in this 2021 Action Plan and the following three documents:

- Standard Specification for Highway Construction and Maintenance;

- Provisions for Use of Liquid Anti-stripping Asphalt Additives on 2021 NSTAT Projects; and the
- 2021 Check List for Liquid Anti-Stripping (LAS) Asphalt Additive Projects.

Items to be discussed also include equipment specifications, site-specific safety plan, safe work practices, use of protective equipment and worker information sessions. The responsibilities of NSTAT, the contractor and any other parties must be clearly defined.

For projects using an amine-based liquid antistripping asphalt additive, additional items must be discussed, including respiratory protection and protection of sensitive workers. The On-Site Representatives of the department and the contractor must be identified and their authority to act with respect to any on-site project contingencies must be established.

11. Worker Information Sessions

Worker information is a critical part of the Action Plan. All supervisors and workers, including liquid asphalt cement carriers, asphalt hot or warm mix plant crews, asphalt concrete (hot or warm mix) truckers, paving crews, NSTAT project engineers, inspectors, checkers, consultants, etc., must be given a copy of the current year's Action Plan and a formal Information Session in advance of starting work.

The Information Session (or refresher session) must include a review of the 2021 LAS Action Plan, identification of the liquid anti-stripping asphalt additive which is being used and a review of a current Safety Data Sheet (SDS) for the hot or warm liquid asphalt containing the liquid anti-stripping asphalt additive, proper procedures to follow, use of protective equipment, reporting of illness, etc. These sessions are designed to provide up-to-date, reliable information to all present at the project.

Workers who have attended previous Information Sessions do not need to attend the current session, but must be given a copy of the current year's Action Plan and be informed in a refresher session of any changes to on-site procedures and the location of the current Safety Data Sheets.

12. Protective Clothing and Personal Protective Equipment

Using protective clothing and personal protective equipment (PPE) is a proactive approach which works together with engineering controls and safe work practices to prevent or reduce exposure to a hazard. Sometimes the use of protective clothing is just good safety practice and sometimes it is required by OHS regulations. Use of PPE can stop problems from developing where additional protection is required.

For LAS additives, protective clothing and PPE may act as a barrier between the person and the toxic chemical, keeping workers from being affected by the product or allowing workers who are sensitive to the product to continue working with it.

- Skin protection is primarily to prevent contact with hot mix, thus preventing thermal burns—no short pants, cut-offs or bathing suits.

- Shirts should cover the trunk of the body—no net shirts or tank tops. Long sleeves provide better protection, but in hot weather, short sleeves or no sleeves are a reasonable accommodation.

- Safety boots should be laced up to prevent hot mix from getting inside the boot.

- For any operations which are not inside an enclosed vehicle, trailer, or building, a hard hat must be worn.

- Removing Asphalt Containing LAS from Skin—If your skin gets soiled from contact with hot or warm mix containing LAS additive, do not panic. The main hazard is thermal burns from the heat of the hot asphalt mix. Give first aid for any thermal burns and seek medical attention if the burn needs cleaning.

- If the skin is not burned, use soap or commercial hand cleaner to gently remove the tarry asphalt from the skin. This is all that is required.

- Removing Asphalt Containing LAS Additive from Clothing—Treat asphalt hot mix or warm mix cement containing liquid anti-stripping asphalt additive the same as any other asphalt. Boots, gloves and clothing contaminated with asphalt that contains anti-stripping additive do NOT need to be discarded. They should be stored and cleaned the same as those contaminated with ordinary asphalt cement.

- Eyes—safety glasses required when outside. They may be tinted safety glasses to protect the eyes from the sun.

- Nose, throat, lungs—Respiratory Protective Equipment (RPE), which also protects the eyes when “full-face” RPE is worn. For hot or warm asphalt mixes containing a non-amine based liquid anti-stripping asphalt additive, respiratory protection will not usually be needed, but projects using amine-based additives must be prepared for the potential need for respiratory protective equipment (see section 14)

Note that the remainder of this Action Plan applies ONLY to liquid anti-stripping asphalt additives that are based on reactive amine chemistry.

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13. Experience with the Use of Amine-Based Liquid Anti-stripping Asphalt Additives in Nova Scotia

As noted in **Section 2. Background**, in 1994, amine-based LAS additives were used experimentally on three paving projects, which unfortunately resulted in severe health effects to many workers on those projects. Research identified the ingredients responsible for the health effects. The selection of new products and the development of the LAS Action Plan resolved many of the issues.

In 1995, air testing was undertaken at selected projects where the new anti-stripping asphalt additives that had passed the department's health effects screening were used. All results were very low, confirming that the newer products released very little volatile amines or solvents to the air. All results were much lower than applicable occupational exposure limits with most results being below the limit of detection of the analytical methods.

Each year since then, the Action Plan has been updated as experience in working successfully with amine-based liquid anti-stripping additives increased, and in the light of any new problems experienced. The Action Plans have included revised NSTAT Contract Specifications, contractor planning and worker information sessions, and have included a series of progressive actions to be taken to protect affected workers.

Protective measures now include product selection, modification of equipment, safe work practices, restricting paving operations during damp or wet conditions, use of personal protective equipment when required, and relocating affected workers to work areas where there is less exposure to the additive. Finally, when necessary, affected workers must be moved to another project where there is no exposure to the additive.

Historically, symptoms appeared to be more likely to develop when working in the smoke from the hot mix plant or after a period of several days of exposure on paving operations. Symptoms occurred particularly after exposure during wet conditions, when the steam rising from the pavement carried traces of the amine additive into the air breathed by workers.

During the 1995 to 2020 paving seasons, most of the projects proceeded without incident and the newer products seemed to virtually eliminate the problem of eye irritation. Only a few workers have reported mild symptoms such as dry lips, dry mouth, coughing spells, nausea, feeling faint, a feeling of burning in throat or chest, or headaches. Usually these symptoms would disappear after a few minutes spent in uncontaminated air. In the very few more severe cases, symptoms disappeared within a couple of days after exposure to the amine-based liquid anti-stripping additive stopped.

In the 2008, 2009, 2010 and 2013 to 2020 paving seasons no adverse health effects were reported to the Department from any of the projects using amine-based liquid anti-stripping additives.

The following are examples of the problems identified and what was learned.

On a project at the end of the 2003 season, the supplier ran out of hot liquid asphalt cement and sub-contracted to another supplier. The new supplier provided an amine-based LAS additive that was not on the NSTAT list of “Acceptable” products that had passed the health screening. Many workers got sick (sore mouth, throat and lungs, vomited). The project was shut down while the hot liquid asphalt cement was exchanged for new hot liquid containing an approved LAS additive. The project resumed with no problems. The unfortunate experience we had with this project clearly demonstrated that the amine-based LAS additive which was on our Nova Scotia “Acceptable” list was less toxic to the workers than the amine-based LAS additive which had been supplied in error, proving the benefit of having developed the list as part of the NSTAT Action Plan.

On a 2004 project it was discovered that the refinery had put too much amine-based liquid anti-stripping additive in a transport tank truck. The load was refused. Another load with the correct concentration of amine-based liquid anti-stripping asphalt additive was sent and the project continued without incident.

In the 2011 paving season, one worker reported feeling faint after transporting a sample of asphalt in the cab of his truck. It is not known whether this was due to anti-stripping additive in the asphalt sample, off-gassing from the asphalt cement, or some other cause, but this incident is reported for the sake of completeness.

In the 2012 paving season, several Department and contractor workers who were working with a hot mix containing a non-amine based liquid anti-stripping asphalt additive experienced mild throat and eye irritation and used respiratory protective equipment periodically. The cause of the irritation is not known, but since the hot mix contained 20% Reclaimed Asphalt Pavement (RAP), it may have been something in the RAP that caused the symptoms, including the possibility of liquid anti-stripping asphalt additive in the original hot mix.

There have not been any incidents of health effects reported since 2012.

14. Site-Specific Safety Plan and Project-Specific Safe Work Practices

In advance of work starting, a Site-Specific Safety Plan must be developed, including Project-Specific Safe Work Practices to use in working with liquid asphalt cement or hot or warm asphalt mix which contains an amine-based liquid anti-stripping additive. The Project-Specific Safe Work Practices must be included in the information session for each group of workers. The Safety Plan and Safe Work Practices must:

- identify the proper location of the hot or warm mix plant in relation to the layout of the pit, quarry or other location where it is to be set up, taking into consideration the direction of prevailing winds;

- include the requirement for asphalt spreaders (pavers) used on amine-based liquid anti-stripping projects to be equipped with local exhaust ventilation designed to capture and discharge fumes and vapours generated during the lay-down operation;

- include the actions to be taken in various moisture conditions, such as:
    - delaying the start of paving until any standing water has drained or been removed from the road surface and the road surface is dry;
    - delaying the start of paving until morning fog has lifted and dew on the road surface has evaporated and the road surface is dry;
    - requiring the use of half-face respiratory protection during any short period of ground level fog or mist during the day; and
    - stopping paving operations at any time that it starts to rain. Tarpaulins should be placed over any trucks containing hot or warm mix. If the rain stops within 15 minutes, paving may resume once the road surface has dried. If the rain continues for more than 15 minutes, paving should cease until dry conditions return and the trucks containing hot or warm mix should be instructed to dump their loads at an approved disposal site.

- include the importance of avoiding contact with the hot or warm liquid asphalt cement or hot or warm asphalt mix containing amine-based liquid anti-stripping asphalt additive through the wearing of boots, long pants and a shirt to protect the skin. (These precautions are similar to precautions which should be used for hot or warm liquid asphalt cement or asphalt hot or warm mix concrete which does not have any liquid anti-stripping additive.) Natural fibre, such as cotton, wool, hemp, jute, linen, etc., is preferable to synthetics, such as nylon, polyester, rayon, etc., when protecting from the hazard from hot materials;

- include the importance of avoiding excessive breathing of the vapours from materials containing amine-based liquid anti-stripping additive by standing up wind to avoid exposure to vapour where possible, and by the use of respiratory protective equipment where necessary; and

- identify tasks where exposure to vapours from the liquid asphalt cement containing amine-based liquid anti-stripping additive could be high and will therefore require the mandatory use of respiratory protective equipment. For example, unless there is a

local exhaust ventilation system installed to capture any vapours released, when a worker must open a hatch on a hot or warm liquid asphalt cement storage tank, transport tanker or other vessel, they must wear full face respiratory protective equipment with organic vapour cartridges and dust pre-filters.

Note that Model Safe Work Practices for Hot or Warm Mix Plants, for Paving Sites and for Hot or Warm Mix Truckers on amine-based projects are available from NSTAT to assist in the development of the Site-Specific Safety Plan and Project-Specific Safe Work Practices.

15. Respiratory Protective Equipment (RPE)

Respiratory Protective Equipment (RPE) required must be provided without cost to any workers who are performing tasks where exposure to amine-based anti-stripping additive vapours could be high, to any workers who experience symptoms from exposure to the additive and to any workers who request to use RPE on a voluntary basis. NSTAT will supply RPE to its employees and to its consultants. Contractors will supply RPE to their workers. Independent truckers must supply their own RPE.

Respiratory Protective Equipment must be selected for the specific circumstances in which it is to be used, and must meet the following specifications:

- all RPE, including replacement components, must be approved by the US National Institute of Occupational Safety and Health (NIOSH);
- when eye irritation is not a problem, the RPE may be of the “half-face” (auri-nasal) type;
- when eye irritation is a problem, the RPE must be of the “full-face” type to protect the eyes as well as respiratory system;
- when a worker may be directly exposed to concentrated vapours of hot or warm asphalt cement, such as from the open hatch on a hot or warm asphalt storage tank, the RPE must be of the “full-face” type;
- a worker who only requires RPE for short or intermittent time periods, such as to avoid minor throat or lung irritation, must be provided with a standard air purifying “half-face” respirator;
- a worker who is not physically affected by the amine-based anti-stripping agent but finds its odour to be objectionable or who voluntarily wishes to try a respirator must be provided with a standard air purifying “half-face” respirator for as long as the worker wishes;
- when a worker requires RPE for continuous or extended time periods (such as might be required by a worker who has become sensitized to the amine-based anti-stripping additive), a Powered Air Purifying Respirator (PAPR) must be provided;

- the RPE must be equipped with organic vapour cartridges and dust pre-filters (or provide equivalent protection). Some users have found the combination organic vapour/acid gas cartridge and dust pre-filters also give acceptable results, but this combination may have a shorter service life;

- organic vapour cartridges or organic vapour/acid gas cartridges must be replaced whenever there is "break-through" (smell) of vapours into the mask.

- dust pre-filters must be replaced when they become visibly dirty or when the resistance to breathing becomes noticeable;

- for air purifying respiratory protection to work effectively, it is necessary for it to have a close seal with the face. Therefore, areas of the face where the respirator makes contact with the face must be clean shaven;

- every worker who is required to use RPE of the “full-face” or PAPR types, or who must use a “half-face” respirator to protect against further exposure when symptoms have been experienced from exposure to the amine-based liquid anti-striping agent or because of provisions of the Site-Specific Safety Plan or Safe Work Practices, must be given a qualitative or quantitative fit test to ensure that the respirator has an adequate fit; and

- qualitative or quantitative fit testing is not required for workers who do not need respiratory protection or who are not experiencing symptoms of exposure but who voluntarily use “half-face” respirators because of product odour or personal wishes.

16. Contingency System

The objective of the Contingency System is to have **“site-based” decision making for any problems which develop,** so that immediate and appropriate action can be taken. At all times when work is in progress, each project on which an amine-based liquid anti-stripping asphalt additive is used must have both a Contractor's On-Site Representative (Superintendent, Foreman, etc.) and a NSTAT On-Site Representative (Project Engineer, Operations Supervisor, Inspector, etc.) on site, each of whom is thoroughly oriented to deal with any problems. These representatives must be authorized to make decisions on behalf of the contractor and NSTAT respecting any health or safety issues that may arise during the project.

When it is necessary for the Contractor's On-Site Representative or the NSTAT On-Site Representative to leave the workplace, they must first identify an on-site person who is authorized to act on their behalf during their absence so there will be no delay in on-site decision making regarding any health or safety issues during the period of absence.

The identities of the Contractor's On-Site Representative and the NSTAT On-Site Representative, and the names of their delegates when they are absent from the workplace, must be made known to all workers on site.

17. Protecting the Sensitive Worker

A key part of the Action Plan for the use of amine-based liquid anti-stripping asphalt additives is to consider a series of progressive actions to be taken in the event that any worker is adversely affected by the vapours (nose, throat, or lung irritation, eye irritation, headache, etc.) or feels nauseated by the odour from liquid asphalt cement or asphalt concrete (hot or warm-mix) containing the amine-based liquid anti-stripping additive.

- The **first line of defence** has been to carefully evaluate a number of amine-based liquid anti-stripping asphalt additives and select only those which will be less likely to give rise to health effects in exposed workers. Specifically, products have been selected which have low odour, low irritant potential, and low volatility (are less likely to give off vapours to which workers could be exposed) and have no evidence of long term health effects. Coupled with this choice of products are engineering controls, a Site-Specific Safety Plan and Project-Specific Safe Work Practices which are designed to reduce exposure to the greatest extent possible.

- The **second line of defence**, if a worker has a reaction to vapours from the amine-based liquid anti-stripping asphalt additive (nose, throat, or lung irritation, eye irritation, nausea, headache, etc.), is to provide that worker with RPE (see section 14). Respiratory Protective Equipment for specifications).

  This protection must also be provided on request to any worker who finds the odour from the amine-based liquid anti-stripping asphalt additive to be objectionable or who wants the security of additional protection and who voluntarily wishes to wear RPE.

- The **third line of defence** is relocation of any affected worker. If the RPE does not provide sufficient protection to a worker, or a worker is unusually sensitive to the vapours of the amine-based liquid anti-stripping asphalt additive, they must be reassigned to work in an area where there is less exposure to the product and where the worker is not affected. Whenever a worker is relocated, the NSTAT On-Site Representative must be notified.

  Very occasionally, a worker may need to be relocated to another workplace altogether, where amine-based liquid anti-stripping asphalt additive is not being used. If it is necessary to relocate a worker to another workplace, the NSTAT On-Site Representative must be notified, who must in turn notify NSTAT senior management and the HSE Division of NSTAT.

- No worker is to be financially penalized for being reassigned to work in another area with less exposure or for being relocated to another workplace where amine-based liquid anti-stripping additive is not being used. Therefore, pre-relocation wage rate must be maintained for contractor employees, NSTAT employees and consultants contracted to NSTAT. This financial protection does not apply to independent hot or warm mix truckers.

18. Further Information

This document does not contain all the detail required for a specific project. Additional information will be required:

- contractors must obtain from their liquid asphalt cement supplier (generally an oil refinery or bulk distributor) a copy of the Safety Data Sheet (SDS) for the modified liquid asphalt product to be used. This SDS must have information about liquid asphalt cement containing the liquid anti-stripping additive being used in the concentration range being used (i.e.: typically a SDS for a 0.1% to 0.5% concentration of the liquid anti-stripping additive in 99.5% to 99.9% liquid asphalt cement). Note that the SDS for the pure liquid anti-stripping asphalt additive will not be appropriate for paving operations;

- workers must have access to the SDS for the liquid asphalt cement containing the LAS additive.

Additional detail for projects using an amine-based liquid anti-stripping additive:

- contractors must develop a Site-Specific Safety Plan and Project-Specific Safe Work Practices for each operation where a worker could be exposed to vapours from asphalt containing amine-based liquid anti-stripping asphalt additive, and should ensure that all supervisors and workers are trained in these practices. Note that Model Safe Work Practices for Hot or Warm Mix Plants, for Paving Sites and for Hot or Warm Mix Truckers on projects using amine-based additives are available from NSTAT to assist in the development of the Site-Specific Safety Plan and Project-Specific Safe Work Practices;

- workers must be given additional information, including information on the Site-Specific Safety Plan and Project-Specific Safe Work Practices;

- contractors may wish to consult the Nova Scotia Road Builders Association, the Nova Scotia Construction Safety Association, or other expert sources for further information on health and safety programs and for advice on Safety Plans and Safe Work Practices; and

- contractors should consult with their safety equipment supplier respecting the selection, use, care and maintenance of Respiratory Protective Equipment; fit testing of RPE for workers who require it (see last two bullets of Section 14), and for other health and safety equipment.

19. Resource Materials

A Trainer's Package, including the 2021 Action Plan, a PowerPoint Presentation (which can also be used to produce overhead transparencies), speaking notes and background materials (such as Model Safe Work Practices, etc.) is available to assist in providing Worker Information Sessions based on this Action Plan.

All trainers must have attended a Train-the-Trainer session organized by NSTAT, although it does not have to be a session held in 2021. Trainers who have not attended a Train-the-Trainer session may arrange for one through NSTAT. Refresher training for trainers who have previously attended a Train-the-Trainer session may also be arranged through NSTAT.

Trainers who have attended previous sessions who have not already received 2021 training materials should request these materials from NSTAT. Electronic copies sent by email will be provided at no cost. Hard copy materials or electronic copies on a CD or DVD will be provided at a minimal cost.

Nova Scotia Transportation and Active Transit will be pleased to receive comments on this Action Plan and the associated documentation.

Requests for an updated Trainer's Package (for trainers with previous training), Train-the-Trainer Sessions (for new trainers or as a refresher for trainers with previous training) or comments on the Action Plan should be directed to:

Catherine MacLeod, CRSP, CHSC, NEBOSH
Health, Safety and Environment Manager
Transportation and Active Transit
1672 Granville Street, 5th Floor
PO Box 186, Halifax, NS B3J 2N2
Office: (902) 722-5085
Cell: (902) 476-9879
Fax: (902) 424-0570