

## **A new standard XP P98-181 to characterize the performances of de-icers**

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### **1 ABSTRACT**

In France, sodium chloride (NaCl) remains a reference as a de-icer in road winter maintenance (used in 99% of the situations). Its specifications as de-icer are detailed in the standard NF P 98-180 [1].

Nevertheless, in case of specific situations, of their constraints, some products with particular properties of functionalities might be used.

Since 2011, these products, along with sodium chloride, have a standard to structure their use as de-icer. This is an experimental standard XP P98-181 [2] "Materials and products of road maintenance - Solid and liquid de-icers for winter service of roads and lanes of specific use - Performances criteria.

It is now possible to check if a product does really have the physical and chemical properties specific of a de-icer, and to evaluate its main performances (storage ability, spreading, efficiency, ice melting, impact on the structure, the environment and on health where it is applied).

Providing to suppliers a common and objective evaluation grid of specifications and performances clarifies the market.

The choice of a de-icer the most adapted the one needs is now easier for road managers.

### **2 WHY SUCH A STANDARD?**

#### **2.1 Existing practises to be improved**

A great majority of road managers find a satisfactory answer to their needs with "a sodium chloride in conformity with the specifications of the NF P98-180 standard". Nevertheless, other de-icers are sometimes used.

Up to now, there is a non exhaustive list of ionic de-icers, including mainly Calcium and magnesium chloride, acetate and formate with a restrictive road use but globally used on airports, by-products and co-products from industries, mixtures and products providing specific functionalities (anti-corrosion additives, non polluting one, dyes, ...).

These de-icers were previously subjected to a preliminary study, more or less extended, before their use by the road manager. Nevertheless, the commercial description was often the only available reference, which was not enough and subjective. Furthermore, data related to consequences on pavement (grip variation as an example), a possible negative impact on human health or the environment was not always mentioned or described. A more structured answer is now possible within the frame of this new standard. It defines specifications and performance for each, along with requirements declined in classes.

## 2.2 A better answer to legal requirements of public purchase

Rules of free access to public order, of an even treatment of suppliers and of clear purchase procedures [3] have submitted a majority of road managers to a rigorous expression of technical specifications of de-icers. These are expressed either:

1. with a reference to a standard (case of sodium chloride [1])
2. in terms of functional performances or requirements.

It is also possible to mix both expressions. They will not rule out an even treatment of candidates suppliers.

If a road manager goes for a full or partial description in terms of functional performances or requirements, he can use XP P 98-181 standard. It allows a checking of inner physical and chemical properties of a de-icer, and to evaluate its main performances (storage ability, spreading, efficiency, ice melting, impact on the structure, the environment and on health), which are detailed in chapter 4.

Its recent publication and additional requirements of road managers, out of the standard scope (compatibility with spreading machines as an example) have nevertheless driven to behave with caution, and to an accurate analysis of their choices as expressed in a contract. If so, some help will be found in chapter 3, to answer expectations non taken in to consideration for the use of sodium chloride.

## 3 TO AN APPROPRIATE USE

### 3.1 One application domain

#### 3.1.1 *Which products?*

All de-icers used for road winter maintenance (from highway down to a small lane), and lanes with a specific use (lanes dedicated to some vehicles, bicycles, sidewalks, zones for pedestrians, ...) will be concerned by this standard, whatever they are solid or liquid, or if they are a natural product or manufactured by a chemical industry.

De-icers for non-road surfaces, such as civil or military airports or aircraft de-icing fluids are therefore excluded of this standard. The exclusion also concerns products used for winter services but which are not de-icers according to the terms of the standard (Table 1). Abrasives or other materials used to generate grip on snow (sand, gravels, pouzzolane, or mixtures associating de-icer and abrasive, ...) are outside the standard scope.

Table 1 – Definitions of a de-icer

Definitions of a de-icer:	reference
Product that aims to prevent ice occurrence and/or to ensure the melting of ice or snow. It could be spread as it is, diluted, dissolved or as a mixture.	Article 5.6.1 of NF P 99-320 [4].
Product spread on pavements to reduce the freezing point of water	Article 2.3.2 of NF EN 15144 [5]
A road de-icer is a product intended to avoid ice occurrence and/or to melt ice or snow. It is either solid or liquid. It could be spread pure, diluted, dissolved or as a mixture (cf. NF P 99-320). It has a set of physical and chemical properties, with so a use value within the frame of winter maintenance (storage ability, spreading, efficiency, ice melting, impact on the structure, the environment and on health). And particularly an ice melting capacity in compliance with minimum thresholds as defined in article 5.1 of the XP P98-181.	Article 3.1 of XP P 98-181 [2]
Definitions of abrasives:	according to NF EN 15144 [5]
Abrasive: spreading product, natural or not, used to increase a surface roughness that became slippery.	Article 2.3.5
Stone, small size stones, gravel: spreading product made of broken natural minerals.	Article 2.3.6
Sand: abrasive spreading product made of mineral grain of small size.	Article 2.3.8

There is a specific case of de-icer essentially containing solid sodium chloride. They are with the scope of use of the XP P 98-181 standard [2], with the complements of NF P 98-180, except for production conditions, the natural origin being the only acceptable ones in this standard [1].

### 3.1.2 About the interest of this standard ... to what its limits

Such a common reference clarifies the relationships between suppliers and road managers.

Road managers do have a list of specifications and performances which definitions and testing protocols are described. The choice of the ones the most adapted to answer their expectations is then eased.

It provides an objective and standardized comparison basis of performances and of perimeters of use of different de-icers available on the market. It considerably reduces qualification tests performed by suppliers previously requested by road managers. These ones can take some perspective with respect to technical and commercial arguments to judge offers, at least on performances provided by the standard.

It offers a minimum frame of environmental criteria and of safety use to be satisfied and which omission would cause a prejudice to all. The same applied about tracking the origin of de-icers and of their mandatory accompanying mentions.

Nevertheless, this global frame of the standard has to be transferred to local and specific needs of each. The reference to the standard might not be enough, and a road manager has to give detailed choices, and if necessary complementary ones. In other words, "a de-icer compliant with XP P 98-181" does not mean anything.

Indeed:

- A de-icer, which would be compliant to all requirements and the highest performances of this standard, does not exist up to now. There is so a real need for

a road manager to reduce his choice to performances the most essential to have his expectations satisfied, and to rank them.

As an example, the corrosion capacity of a de-icer is not that relevant in the case of a new network or one properly maintained. In such a context, the highest requirements are useless.

- The same applies when several requirements classes are associated to a performance. The required level as indicated by the road manager is the translation of his needs, no more nor less. Reaching the largest panel of eligible de-icers with an adequate price level is an expectation too. It is then useless to implement restriction to the market with technical requirements without real interest or without real interest or stake.
- The choice of a greater performance level, or even to add specifications or specifications to the standard is sometimes explained by local necessities. As an example, the environmental requirement is the expression of a balance between the pollution generated by the de-icer and the vulnerability of the location receiving it. It does not only depend on the de-icer. Obligations associated to the second component could be other and more severe than the ones developed in the standard.
- Beyond the standard perimeter, additional investigations and checkings have to be performed by the road manager. They essentially concern the ones validating the agreement between the expected de-icer and the organization and the means of winter service. These aspects are detailed in chapter 3.3.
- Without omitting the financial part, there are costs attached to the purchase and the management (logistics, storage and preservation, handling, spreading, ...), and the ones induced by its use (considering an equivalent efficiency, what the necessary amount in tons?).
- There is a legal aspect to consider too. Being chemical product, and considering their use and the amounts spread, some de-icers must have a safety data sheet FDS (dangers presented by chemical substances and mixtures have to be clearly communicated to workers and consumers through their classification and their labels [7]). They might also be concerned by the REACH regulation [8] which aim is to protect human health and environment against risks related to chemical substances.

### 3.2 Who dos what?

A validation by the hierarchy has to be completed prior to the use of a de-icer, and as soon as it does not comply with the general security frame defined in chapter 4 of the XP P 98-181 standard, or might induces major evolutions in the current organization of the road manager (elaborated on the use of NaCl).

The compliance with specifications and the determination of a de-icer performances have to be performed by the entity presenting the product to the road manager. Its positions with respect to the XP P 98-181 standard are of the responsibility of the entity generating the contract with the road manager, being the manufacturer, the company conditioning the product, the one importing it or a retailer.

Testing methods are exhaustively described to be implemented by any testing laboratory. Depending on companies, the cost of the whole testing of specifications and performances ranges between 4000 and 6000 euros, tax excluded.

### 3.3 The mandatory preliminary needs analysis, or "how to choose his de-icer?"

A proper evaluation of needs is not a simple warranty of a purchase in the best economic conditions, but a requirement for a good winter service. To be efficient, the expression of the needs relies on several main considerations:

- The analysis on functional needs of the road manager on the basis, as an example, of consumption, of expected performances with respect to objectives of quality of the network and the prescriptions of use of the de-icer (delivery, storage, handling, spreading, ...).
- A knowledge as accurate as possible of suppliers markets.
- A difference between conventional expectations and specific ones.
- And finally an approach chosen as a global cost taking into account not only the purchase price but also the costs related to the associated use of the purchased de-icer. The road manager can also take into consideration sustainable considerations.

The approach presented after is intended to identify the "needs to be satisfied" in the form of a grid of questions. The entrance key is similar to the one of sodium chloride, which now comply with the needs of a majority of road managers. This is an application of the XP P 98-181 standard. It brings into light questions not covered by the standard scope.

Through a cross analysis of expectations and the values of use of different de-icers on the market, a selection adapted to his situation should be obtained. An ideal de-icer does not exist, therefore the analysis provides the "best compromise"

Nevertheless, the choice of a new de-icer goes with an evolution of the organization of winter service previously built on the use of sodium chloride.

In the context of the author activity, what are the ten good questions to ask, and the analysis to do? They are the line to follow to choose the most adapted de-icer.

<b>N°1</b>	<b>What is (are) the need(s) not satisfied by the use of NaCl?</b> <i>Identify (nature and frequency) and rank (from the most essential to the optional) them</i>
<b>N°2</b>	<b>Could the NaCl use on another form (solid, liquid, mixture) answer this(these) need(s)?</b> <i>If yes, the analysis stops, elsewhere please continue</i>
<b>N°3</b>	<b>What are the specifications and the performances to satisfy the need(s)?</b> Chapter 4 provides detailed specifications and performances of the standard, along with their opportunity <b>Among the ones present in XP P98-181</b> <i>Choose and rank adapted specifications and performances</i> <b>And the ones missing in la XP P 98-181</b> <i>Identify (nature and frequency) and rank (from the most essential to the optional) them</i> <i>Find documents to characterize them (standards, tests, ...)</i>
<b>N°4</b>	<b>Among available products, are there de-icers meeting my need(s)?</b> <i>Identify de-icers on the market (name and supplier), their availability and their performances, and physical and chemical characteristics (based on SDS, control conclusions according to XP P98-181, technical documentation)</i>
<b>N°5</b>	<b>Is this a de-icer?</b> according to its compliance with the definition given in article 3.1 and the minimum requirements given in article 5.1 of XP P98-181 <i>Exclusion of non compliant de-icers</i>
<b>N°6</b>	<b>What are their position with respect to requirements defined in question N°3?</b> Analyze each de-icer individually in the list of required performances <i>Generate a summary table of de-icers and their position with respect to each expected performance</i>
<b>N°7</b>	<b>Is the supplier able to cope with an order?</b> <i>Evaluate the ability of each supplier to answer in a sustainable way to an order</i> <i>Rank selected de-icers and suppliers</i>
<b>N°8</b>	<b>My choices must take into into account global considerations on safety (staff, equipments and environment):</b> For all settings defined in article 4 "safety - precautionary principle - specifications", each selected de-icer has to be analyzed <i>Analyse the general rank of a de-icer and identify non-compliant points or sensitive ones</i>
<b>N°9</b>	<b>Are de-icer prescriptions of use compliant with my local context?</b> Each road manager has an organisation, a staff and equipments dedicated to winter service. From something built on the use of NaCl, what will need to be adapted, changed or invested for the use or another de-icer? To the 3 themes which are security, tools and organisation of winter service, some other might be added if imposed by the local context.
<b>N°9.1</b>	<b>Are my safety constraints and requirements respected?</b> Does my local context need a more restrictive definition of some requirements of the standard or additional settings? If so, which ones? What is the situation of the de-icer with respect of these new settings? <i>See the global position of the de-icer, and identify the points of non compliance or sensitive ones</i> <i>Build a base to make a comparison between de-icers (to rank them)</i>

<b>N°9.1</b>	<p><b>The adequacy with my tools is completed, and what are the evolutions to consider?</b></p> <p>Les adaptations à apporter aux outils et procédures de stockage, de manutention, d'épandage, de sécurité individuelle et collective, de gestion des achats, de maintenance des outils et d'élimination du fondant...</p> <p><i>Identifier les évolutions techniques à apporter et les investissements (nature, volume, coût) et de leur faisabilité, point par point.</i></p>
<b>N°9.3</b>	<p><b>Major impacts on my winter service organization are identified</b></p> <p><i>Avoir une bonne connaissance des évolutions à apporter localement, mais aussi de leur faisabilité et recevabilité, à minima sur les points suivants :</i></p> <p>a- La définition de nouvelles consignes de traitement (selon les phénomènes météorologiques), et leurs conséquences</p> <p>Les nouveaux dosages et leurs limites d'efficacité, structurent la consommation prévisible de fondant, le dimensionnement des circuits (autonomie des épanduses), la durée d'engagement des équipes, et leurs coûts associés</p> <p>b- L'accompagnement des personnels pour un usage efficace du fondant</p> <p>Sans exhaustivité cela recouvre toutes les mesures d'accompagnement des personnels, pour une utilisation optimale et en sécurité du fondant. À savoir la formation, les EPI, le suivi médical, et autres préconisations de la FDS....</p> <p>c- Les obligations réglementaires associées à l'usage d'un produit chimique (cf. chapitre 3.1.2 dernier alinéa)</p> <p><i>Identifier les fondants concernés, les conséquences respectives du fournisseur et du gestionnaire routier dans son contexte</i></p>
<b>N°10</b>	<p><b>What is the relevance level to look for de-icers other than NaCl?</b></p> <p>Au terme de cette analyse, le gestionnaire a une bonne connaissance des fondants qui satisfont ses besoins, leurs performances, et les contraintes associées.</p> <p>La disponibilité des fondants, leur nombre et la faisabilité des évolutions à apporter à son organisation actuelle du service hivernal structure son choix</p> <p>Résultat positif :</p> <p><i>Confirmer ce choix par une validation hiérarchique surtout si les impacts sur l'organisation du service hivernal ou les coûts financiers sont réels.</i></p> <p><i>Procéder à la rédaction des clauses de performances ou/et d'exigences spécifiques du cahier des charges d'achat servant de base à la mise en concurrence des fournisseurs.</i></p> <p><i>Apporter à son organisation actuelle du service hivernal les évolutions nécessaires</i></p> <p>Résultat négatif :</p> <p><i>Il y a nécessité à conduire d'autres actions, que celle de l'emploi d'un fondant nouveau, pour répondre au/x besoin/s exprimé/s (question n°1)</i></p>

Figure 1 - Analysis grid

#### 4 PRESENTATION OF MAIN SPECIFICATIONS AND PERFORMANCES

The standard offers a de-icers' characterization that will cover needs. The road manager has to choose among these specifications and performances, and for some of them to indicate his requirement level.

The search of a high performance level on all criteria is not a priority, which is more an optimum satisfaction of the sole criteria answering the needs.

Presented specifications and performances in the standard are described below. They are divided in three axes: one fundamental related to safety and precautionary principle, traceability and specific performances.

Methodologies and standards implemented to determine the specification or the performance class are described in the standard, and not detailed in this paper. They may vary from commercial presentation.

Sampling is performed on commercially available product, and not only of on active compound(s), and when specified by the standard, at the rate prescribed by the supplier.

#### 4.1 Safety and precautionary principle

In winter maintenance of road networks, safety remains one major concern. The choice and the use of a de-icer have to meet this requirement. It mainly covers staff safety (persons in charge of winter service, of de-icer supply, the one of road users), the preservation of places and environment (storage sites, treated roads and natural impacted sites).

Through article 4 entitled "safety - Precautionary principle - Specifications", the standard provides a global frame and quite flexible to find answers to such expectations. It translates the basis of minimum requirements of the domain, on which the road manager can hardly accept a compromise (without clear reasons).

These requirements are stronger in some contexts, and he will have to count with this legal frame.

Requirements to preserve road infrastructure and the adequacy of de-icers with winter maintenance tools are among the most prevalent situations.

As an example, the compatibility of a de-icer with road surface and equipments exposed to it (unusual materials such as wood, natural stones or on damaged structures) explains the search of de-icers with specific functionalities. The physical and chemical compatibility of the de-icer with storage facilities, brine production and spreading devices (resistance of some polymers, or pumps seals, easy and proper spreading of the de-icer with existing tools, according to de-icer density, relative humidity and grain size, ...).

Furthermore, local environment considerations have the most accurate requirements. The preservation of water resource, of the biodiversity and requirements on public health impose rejects with less impact. It is translated in choices of more restrictive thresholds than the ones in the standard, and more specific and thorough ecological and toxicological evaluations of de-icers

Arrangement of the standard in the article 4 are detailed below:

Table 2 - Specifications relatives to the staff safety and to the preservation of places and the environment

Spécification ou performance de la norme XP 98-181	Objectifs	Classe d'exigence définie à la norme	Éléments d'opportunité associés à cette spécification ou performance et explications complémentaires
4.1- Variation d'adhérence induite	Évaluer la réduction d'adhérence induite par le fondant répandu sur le revêtement	Par référence à un revêtement humide (ref.), le produit doit appartenir à l'une des classes : Classe 1 $\geq 0,90x_{réf.}$ Classe 2 $\geq 0,75x_{réf.}$	L'exigence d'adhérence croît avec la vitesse du véhicule ou la vulnérabilité des usagers (piétons, cycles...) La perte d'adhérence est bornée au $\frac{3}{4}$ de celle du revêtement humide (il ne faudrait pas que le fondant induise une glissance plus élevée que de phénomène météoroutier hivernal dont on souhaite



	Et définir un seuil de réduction réhibitoire		limiter les effets) L'essai se fait sur un revêtement bitumineux (à intégrer pour un usage sur d'autres revêtements (bétons, bois..)), et en reproduisant un traitement préventif (la variation d'adhérence d'un mélange fondant/glace n'est pas qualifiée)																						
4.2- Contenu en métaux lourds et hydrocarbures	Limiter le préjudice à l'environnement	<p>Teneurs maximales en métaux lourds et hydrocarbures totaux (en mg/l) prescrites :</p> <table border="1"> <thead> <tr> <th>Désignation</th> <th>Valeurs maxi</th> </tr> </thead> <tbody> <tr> <td>Aluminium</td> <td>≤ 5,00</td> </tr> <tr> <td>Arsenic</td> <td>≤ 0,25</td> </tr> <tr> <td>Chrome</td> <td>≤ 0,50</td> </tr> <tr> <td>Cadmium</td> <td>≤ 0,20</td> </tr> <tr> <td>Cuivre</td> <td>≤ 0,50</td> </tr> <tr> <td>Mercure</td> <td>≤ 0,05</td> </tr> <tr> <td>Nickel</td> <td>≤ 0,50</td> </tr> <tr> <td>Plomb</td> <td>≤ 0,50</td> </tr> <tr> <td>Zinc</td> <td>≤ 2,00</td> </tr> <tr> <td>Hydrocarbures totaux</td> <td>≤ 10,00</td> </tr> </tbody> </table>	Désignation	Valeurs maxi	Aluminium	≤ 5,00	Arsenic	≤ 0,25	Chrome	≤ 0,50	Cadmium	≤ 0,20	Cuivre	≤ 0,50	Mercure	≤ 0,05	Nickel	≤ 0,50	Plomb	≤ 0,50	Zinc	≤ 2,00	Hydrocarbures totaux	≤ 10,00	<p>Limiter le préjudice à l'environnement, dans la mesure où les eaux de ruissellement routières ne font pas l'objet de traitement des métaux lourds avant rejet au milieu naturel. Et uniquement pour certains réseaux en ce qui concerne les hydrocarbures.</p> <p>Ces valeurs seuils sont très générales et souvent insuffisantes pour des milieux naturels à forte sensibilité.</p> <p>Une vigilance accrue doit être apportée sur les fondants de valorisation de sous-produits industriels ou d'origine méconnue. Attention à la représentativité de l'échantillon au regard de la variabilité de la « production »</p>
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4.3- Valeur du pH	Protection des utilisateurs, risque de corrosion des outils et ouvrages et de dégradation sur l'environnement général	Plage de pH admissible : $5,5 \leq \text{pH} \leq 11,5$	<p>Les seuils sont larges et permettent une gamme importante de fondants.</p> <p>Une telle fourchette n'exclut pas la mise en œuvre de mesures particulières (protection individuelle, conditionnement, exposition...)</p> <p>Les bétons courants sont «attaqués» à partir d'un pH &lt; 6,5</p> <p>Vérifier la stabilité du pH pendant la durée de vie ou lors de l'utilisation (réaction avec le milieu)</p> <p>Information mentionnée à la FDS</p>																						
4.4- Teneur en sulfates solubles	Limiter l'agressivité vis à vis des bétons	Teneur max. < 3 %	<p>Les sulfates provoquent un gonflement interne des bétons</p> <p>C'est une exigence qui s'impose en présence d'ouvrage en béton</p>																						
4.5- Valeur du point éclair	Éviter les risques d'incendie et d'explosion	Valeur minimale exigée de 100 °C	<p>Cette valeur correspond à la température d'auto-inflammation</p> <p>Vérifier la stabilité du point éclair pendant la durée de vie du produit (production – stockages et transports)</p> <p>S'il est peu probable d'un fondant soit exposé à une température de stockage de plus de 100 °C, des températures moindres peuvent induire des sujétions particulières de gestion, notamment en stockage. Précautions à prendre au stockage pour un point éclair bas</p> <p>Information mentionnée à la FDS</p>																						

4.6- Biodégradabilité	Qualifier la biodégradabilité du fondant	Valeur maximale du rapport : $\frac{DCO}{DBO_5} < 5$	<p>Mesure la demande en oxygène de la partie chimique et biochimique du produit. Ne concerne que les produits organiques (Ne s'applique pas aux produits couverts par la NF P 98-180)</p> <p>Apprécier le préjudice potentiel à l'environnement, dans la mesure où les eaux de ruissellement routières font rarement l'objet de traitement des matières organiques avant rejet au milieu naturel.</p> <p>Bien connaître le potentiel polluant du produit au regard de la sensibilité du milieu récepteur et exclure les trop polluants</p> <p>Ces vérifications sont généralement insuffisantes pour des milieux naturels à forte sensibilité (par exemple il n'y a pas d'indication de la dynamique de biodégradation, ni d'expression quantitative des DCO et DBO)</p>
4.7- Pourcentage d'insolubles dans l'eau	Limiter les insolubles résiduels sur le revêtement et dans l'environnement	Teneur maximale en insolubles dans l'eau en fonction de la nature du produit : Liquide < 0,3 % Solide < 0,5 %	<p>La nature des insolubles n'est pas toujours connue</p> <p>Ce paramètre peut varier suivant les approvisionnements, ou production</p> <p>Les insolubles rendent délicate la maîtrise du dosage à l'épandage (colmatage, coulabilité, ...) et salissent les équipements routiers</p> <p>Ne s'applique pas aux produits couverts par la NF P 98-180</p>
4.8- Fiche de données de sécurité (FDS)	Accès aux informations de sécurité nécessaire à l'usage du fondant	La production est exigée Sa structure et sa rédaction sont définies par la norme ISO 11014	<p>À exiger absolument (ne pas faire usage d'un produit dans la FDS n'est pas transmise). L'incapacité ou le refus du fournisseur à fournir la FDS de son fondant offrent un éclairage explicite sur le sérieux de sa proposition.</p> <p>Elle est structurée en 16 rubriques normalisées qui offrent une vue exhaustive du fondant chimique, à savoir :</p> <ol style="list-style-type: none"> <li>1. identification du produit et de la société</li> <li>2. identification des dangers</li> <li>3. composition/information sur les composants</li> <li>4. premiers secours</li> <li>5. mesures de lutte contre l'incendie</li> <li>6. mesures à prendre en cas de dispersion accidentelle</li> <li>7. manipulation et stockage</li> <li>8. contrôle de l'exposition/protection individuelle</li> <li>9. propriétés physiques et chimiques</li> <li>10. stabilité et réactivités</li> <li>11. informations toxicologiques</li> <li>12. informations écologiques</li> <li>13. considérations relatives à l'élimination</li> <li>14. informations relatives au transport</li> <li>15. informations réglementaires</li> <li>16. autres informations</li> </ol> <p>La FDS s'applique au produit chimique considéré comme un tout. Ainsi s'il est le résultat d'un mélange de plusieurs substances, l'ensemble des constituants contribuant aux dangers (nature et concentration) sont examinés dans la FDS (il ne s'agit pas d'une juxtaposition des FDS individuelle de chaque constituant).</p>

4.9- Santé publique et environnement	Être en conformité avec les exigences européennes sur les milieux aquatiques	Les produits dont la composition inclut des substances de la liste I sont interdits, celles de la liste II doivent être explicitées	Être en conformité avec Directive européenne 2006/11/CE, qui limite et interdit le déversement dans le milieu aquatique de certaines substances chimiques dangereuses. L'évaluation des rejets et leur positionnement aux seuils limites d'émissions fixés, conduit à écarter aussi les produits de la liste II, s'il existe d'autres produits (hors listes) à même de satisfaire les gestionnaires routiers
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#### 4.2 De-icers traceability

To guarantee de-icers traceability and to improve the safety of staff in contact with these products (transportation, handling, storage and use), the standard specifies mentions to be indicated on packaging and labels of de-icers, and on delivery form in the case of a bulk material.

These recommendations do not replace the ones of regulations of "chemical products" [7] and the ones of NF P 98-180 standard [1].

#### 4.3 Some specific performances

In addition to requirements and performances related to a safe de-icers use (chapter 4.1), their efficiency and corrosion aspects are evaluated in this standard:

Table 3 – melting power at -10°C on ice, and pouvoir fondant à -10°C sur la glace et corrosivity of de-icers

« Spécification ou performance de la norme XP 98-181	Objectifs	Classe d'exigence définie à la norme	Éléments d'opportunité associés à cette spécification ou performance et explications complémentaires
5.1 – Pouvoir fondant à -10°C sur la glace	Évaluer les capacités d'un fondant à mettre en fusion de la glace à -10°C	Deux seuils : <ul style="list-style-type: none"> <li>• PFI ≥ 5,0 mL</li> <li>• PFE ≥ 300 mL.min</li> </ul>	<p>Les performances associées à ces deux critères sont distinctes :</p> <ul style="list-style-type: none"> <li>• Le PFI traduit la rapidité à faire fondre la glace (après 20 min d'application)</li> <li>• Et le PFE témoigne de la capacité à agir sur la durée (sur un délai de 1 heure)</li> </ul> <p>Sachant que ces deux exigences sont souvent antinomiques (un produit qui agit vite est moins efficace dans la durée, et inversement). Charge au gestionnaire routier de faire son choix.</p> <p>Ne peut être considéré comme fondant routier, un produit n'offrant pas des garanties minimales en matière de pouvoir fondant.</p> <p>Dans le respect des seuils minimaux, l'intérêt du couple PFI/PFE est d'offrir une comparaison entre les produits fondants du marché.</p> <p>Cette performance s'apprécie au regard de son contexte météorologique : tous les gestionnaires routiers ne sont pas exposés préférentiellement à des verglas avec une faible température de l'air (-10°C).</p>
5.2- Caractère corrosif du	Apprécier la corrosivité sur	Pour trois métaux de référence (acier,	Elle s'exprime en perte de masse après un cycle de 1200 immersions / émergences, et ce sur deux

produit	les ouvrages métalliques routiers courants	acier galvanisé et aluminium)		solutions (10g/L et à concentration maximale de solubilité). C'est une réponse aux besoins spécifiques des ouvrages métalliques présentant des pathologies de corrosion et sur lesquels il n'est pas possible de mettre en œuvre de travaux de maintenance (protection anticorrosion). Elle ne présente pas d'intérêt particulier pour un réseau routier neuf ou correctement entretenu.  Le choix de cette exigence facultative, impose au gestionnaire routier de spécifier la classe de corrosion attendue.
		Trois classes de corrosion définies selon la corrosivité :		
		Classe de corrosion	corrosivité en $\mu\text{m}/\text{an}$	
		1 - faible	< 50	
	2 - moyenne	$50 \leq C < 200$		
	3 - forte	$\geq 200$		

## 5 A MATURITY TO BE OBTAINED

Through this standard, de-icers are considered according to a new performances perspective. This perspective was up to now missing in national, and European standards. This standard is still new so its legitimacy has to be validated, on the choice of performances aspects and on the control methodology. That is why authors choose an experimental standard. Once the experimental and probation periods have expired, corrections and evolutions might improve its legitimacy.

This topic is furthermore the subject of recent european works (EN standard), and exists in civil aviation (ASTM and AMS standards). Some consistency might be needed to simplify it, and to reach cost-effective de-icers qualification.

The number of available de-icers is up to now limited since both suppliers and road managers have not yet integrated this new reference.

Results presented here are obtained from preliminary studies conducted during the elaboration of the standard. Some were conducted on products with a great chemical purity and not on de-icers commercially available, and others do not fully respect tests protocols. Their sole value is the trend they provide. They do confirm the diversity of de-icers performances on the market it is better to know.

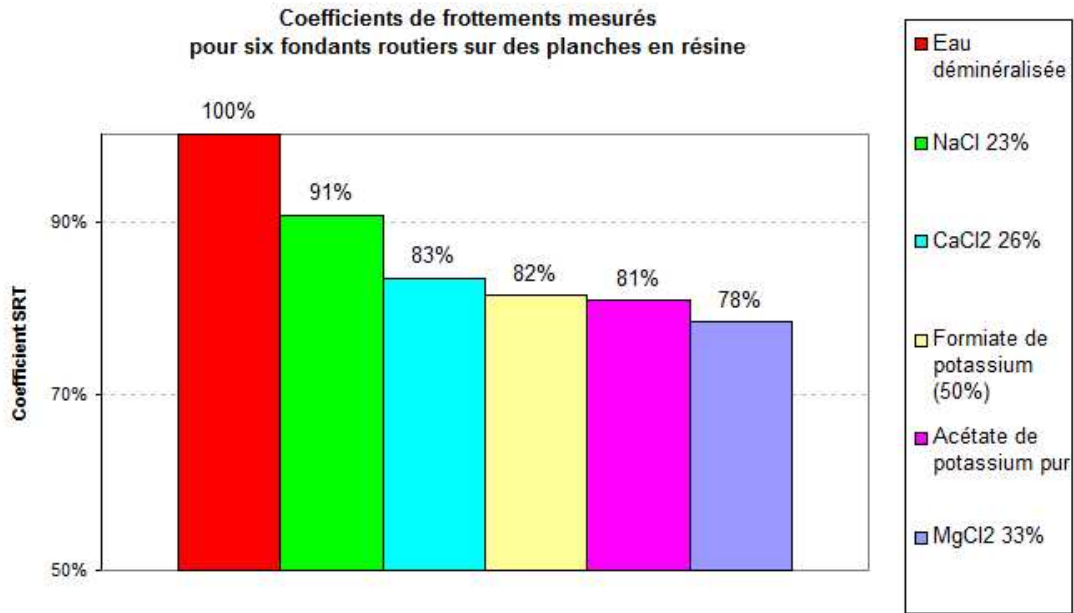


Figure 2 – Grip level on pavement

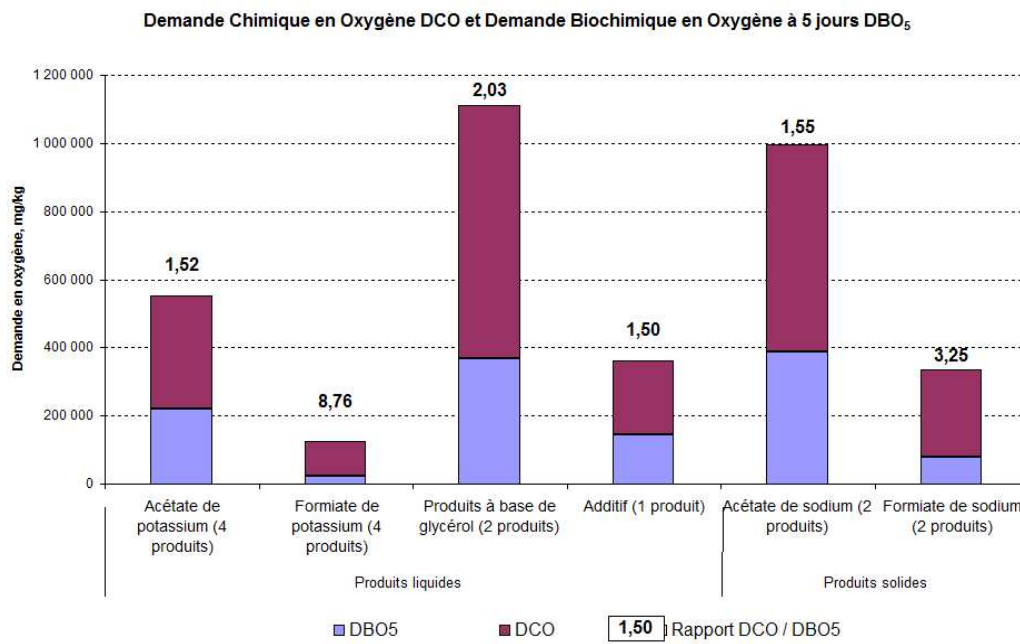


Figure 3 - Biodegradability

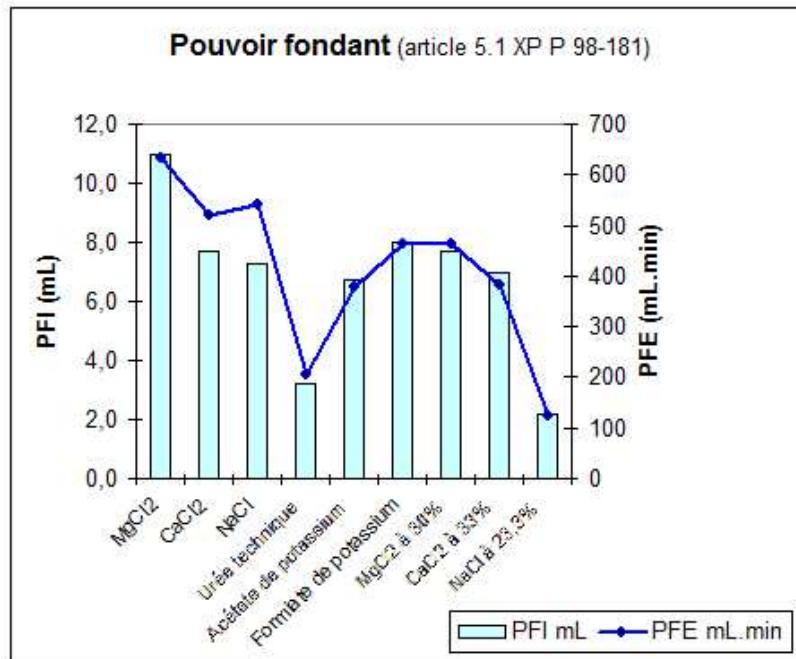


Figure 4 - Melting power

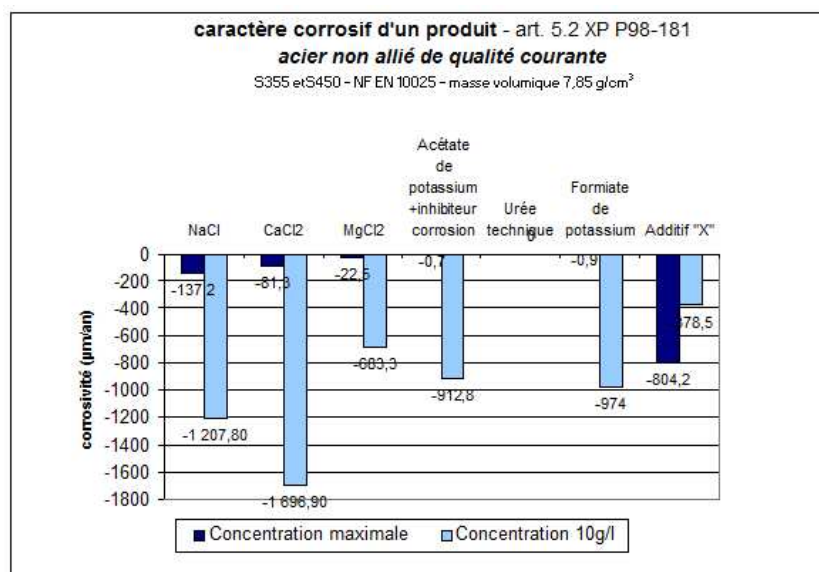


Figure 5 – corrosion capacity of a de-icer

## 6 CONCLUSION

This new standard offers interesting perspectives of performances qualification of current de-icers and the ones to come on the market. A definition similar to all, expected requirements and performances and evaluation methods will bring some balance and will clarify the relationship road manager / supplier.

This help provided to the road manager will not prevent him from an accurate preliminary analysis of his needs to be satisfied. He has to check the agreement between considered de-icers and its organization and means dedicated to winter service, and to think about changes to brought.

## 7 REFERENCES

1. [NF P98-180](#) : Service hivernal – Chlorure de sodium solide utilisé comme fondants – spécifications – juillet 2003
2. [XP P98-181](#) : Matériels et produits d'entretien routier - Fondants, solides ou liquides, pour le service hivernal des routes et voiries d'usages spécifiques - Critères de performance
3. [Code de marchés publics](#) – article 6 – chapitre II Spécifications techniques
4. NF P 99-320 : Météorologie routière - Recueil des données météorologiques et routières – terminologie-avril 1998.
5. NF EN 15144 : équipement de viabilité hivernale – terminologie – terminologie relative à la viabilité hivernale – juillet 2007
6. [Directive européenne 2006/11/CE](#), qui limite et interdit le déversement dans le milieu aquatique de certaines substances chimiques dangereuses.
7. [Règlement \(CE\) n°1272/2008](#) du Parlement européen et du Conseil du 16 décembre 2008 relatif à la classification, à l'étiquetage et à l'emballage des substances et des mélanges
8. Règlement (CE) n°1970/2006 du parlement européen et du conseil du 18 décembre 2006 concernant l'enregistrement, l'évaluation et l'autorisation des substances chimiques, ainsi que les restrictions applicables à ces substances (REACH). <http://echa.europa.eu/web/guest/regulations/reach/legislation>