

# Memo

**Date:** January 4, 2017

**To:** Albert Acquaye – Abt Associates

**From:** Katy Wolf – IRTA

**Subject:** Evaluation of NMP as a Paint Stripping Alternative to DCM

## 1. Background

EPA is considering regulating methylene chloride (DCM) and N-methyl pyrrolidone (NMP) in a variety of different paint stripping applications under TSCA Section 6. EPA prepared risk assessments for the two chemicals and determined that the applications covered in the memo are those where exposure to DCM and NMP is highest for workers and/or consumers.

Under an earlier task, Abt provided IRTA with a memo that identifies alternatives for DCM and NMP in certain paint stripping sectors. The sectors include:

- Aircraft stripping
- Art Restoration and Conservation
- Automotive refinishing
- Bathtub refinishing
- Furniture refinishing
- Professional contractors
- Ship paint stripping
- Graffiti removal

Abt posed five different questions for IRTA to evaluate for the paint stripping sectors and alternatives and these involved assessing the alternatives in the sectors defined above. An earlier memo prepared by IRTA, dated October 1, 2015, addressed the questions posed by Abt for each of the eight sectors. As part of the earlier work, IRTA identified several subsectors or made changes to the sectors that were identified. Since the earlier memo was prepared, new legislation amending TSCA was passed and, as part of the evaluation, Abt has requested that IRTA prepare an additional task which involves evaluating NMP as a potential alternative to DCM. In this memo, IRTA has used the sectors and subsectors identified in the earlier memo to analyze the substitution possibilities of NMP for DCM. In this case, IRTA focuses on estimating the percentage of users that would adopt different alternatives if a regulation banned only DCM and allowed the continued use of NMP in paint stripping.

## 2. General Background on NMP as a Potential DCM Alternative

NMP strippers are often marketed as a “green” alternative to DCM. NMP formulations, however, are reasonable alternatives to DCM strippers in some applications but not in others. Whether or not a particular chemical paint stripper will work in a given task is almost exclusively dependent on the type of coating it must remove. In many cases, as demonstrated in the earlier memo, the substrate does matter

but primarily in applications where non-chemical technologies are appropriate and/or where substrate damage could be an issue.

In general terms, NMP can remove varnishes, lacquers and urethanes but cannot remove other types of paint except with great difficulty. For instance, DCM will start bubbling up a latex or oil based enamel in a few seconds, NMP also will start bubbling it up, but only after several minutes or perhaps an hour. While NMP would eventually work, it would require too much time for many businesses to tolerate. If a business needs to strip only two or three small items per day, it might be feasible from a time standpoint but if numerous items or large items must be stripped, it would simply not be practical.

Overall, benzyl alcohol is a better alternative than NMP as a substitute for DCM. Although benzyl alcohol is slower in stripping than DCM, it can remove many types of coatings in a reasonable period of time that NMP would take much longer to remove.

Another factor that affects the stripping options is that exclusive chemical stripping is not necessarily required in many applications. Non-chemical technologies are often a better option than chemical strippers in these applications from a cost and feasibility standpoint. It is only really in the applications where chemical strippers must be used that the issue of substitution arises.

As discussed in the earlier memo, active ingredients like DCM, NMP and benzyl alcohol are virtually always combined with other components to make a stripper. The active ingredients alone would not be likely to work very effectively in any application and the synergy with other components is important. In some cases, for example, NMP and benzyl alcohol might be combined to make a stripper (it would also have to have other ingredients) which would work on certain coatings that NMP alone would not be able to strip. Depending on the paint being stripped, the NMP might not contribute at all to the stripping capability.

An issue that needs to be addressed is how to characterize consumer stripping. Because so many small businesses purchase and use consumer product strippers from big box stores or on-line, it is not only consumers who use these strippers. While consumers stripping a few items could wait hours for an NMP stripper to work, for example, people operating most types of businesses could not.

In what follows, IRTA discusses each of the sectors and subsectors identified in the earlier memo in turn. In some cases, NMP strippers could work if more time could be devoted to stripping. In other cases, it would simply be impractical to use NMP and, if a chemical stripper is required, benzyl alcohol would be a better option. IRTA is making judgements in all these cases.

### 3. Aircraft Stripping

As discussed in the earlier memo, aircraft stripping is done either by military depots, airline maintenance organizations or private companies which can be small businesses. Older aircraft are made of aluminum and many of the newer aircraft are increasingly made of composite material. There is a movement away from DCM because it does damage composite. In many stripping operations, the fuselage could be stripped with one method and parts stripping could be performed using another method.

Although some chemical stripping is performed with benzyl alcohol, DCM is, by far, the most widely used chemical stripper in this sector. In certain cases, NMP can be used for parts stripping where smaller parts could be immersed in tanks. Although NMP would take a long period to act, it might be

possible to use it to some extent. NMP might also be used in some parts stripping operations where sealants or adhesives, but not coatings, are being removed. In general, however, aircraft coatings are virtually all based on epoxy primers and polyurethane topcoats and NMP cannot strip them in a reasonable period of time. Given a choice, benzyl alcohol would be a better option since there are formulations of benzyl alcohol that can strip the cross-linked coatings used in this sector. Aircraft stripping is increasingly being performed with blasting technologies of various kinds and chemical strippers account for a lower percent of the depainting methods that are used overall.

Table 3-1 shows IRTA’s estimates from the earlier memo for the stripping methods used in this industry today. As the figures show, DCM is still the most widely used stripping method.

**Table 3-1  
Estimates of Stripping Methods Used in  
Aircraft Stripping**

| <b>Stripping Technology</b>    | <b>Percent Used</b> |
|--------------------------------|---------------------|
| DCM strippers                  | 70%                 |
| Benzyl alcohol strippers       | 5%                  |
| Media blasting operations      | 20%                 |
| Other (Flashjet, lasers, etc.) | 5%                  |
| Total                          | 100%                |

If DCM strippers were banned, the vast majority of the conversion would be to benzyl alcohol. Probably 70% of the stripping done with DCM would be converted to benzyl alcohol. Table 3-2 summarizes these estimates presented in the earlier memo assuming both DCM and NMP are banned.

**Table 3-2  
Estimates of Conversion to Alternatives in  
Aircraft Stripping Assuming DCM and NMP  
Bans and Assuming a DCM Only Ban**

| <b>Stripping Technology</b>    | <b>Percent Conversion</b> |
|--------------------------------|---------------------------|
| Benzyl alcohol strippers       | 70%                       |
| Media blasting operations      | 25%                       |
| Other (Flashjet, lasers, etc.) | 5%                        |
| Total                          | 100%                      |

Since NMP is not really a viable option for stripping the coatings used by the aerospace industry, if it were still available, the situation would not change. A few parts stripping operations might convert to NMP, in particular those that contain other types of coatings. Since benzyl alcohol would be a better overall choice, there would be no real reason to use NMP. Table 3-2 therefore represents both the situation where DCM and NMP are banned and the situation where only DCM is banned.

4. Art Restoration and Conservation

A whole range of methods are used in sector restoring paintings, statues, artifacts and documents to their original character. Many different types of water-based cleaners and solvents are used, particularly for painting restoration but also for cleaning sculptures, statues and historic buildings. Much of the work involves cleaning rather than stripping. For the paint stripping task, the choice of solvent depends heavily on the type of paints involved, the substrate and the task. Non-solvent methods are probably also used, possibly light hand sanding for statues and water-based cleaning methods are likely to be used extensively. Other solvents like acetone or mineral spirits are probably also used for removing some types of paints. In the original memo, IRTA estimated that about 90% of the methods used were non-DCM and non-NMP solvent methods and non-solvent methods. Table 4-1 shows the earlier estimates which assumed that only 5% each of DCM and NMP were used currently.

**Table 4-1  
Estimates of Stripping Methods Used in  
Art Restoration and Conservation**

| <b>Methods</b>                  | <b>Percent Conversion</b> |
|---------------------------------|---------------------------|
| DCM strippers                   | 5%                        |
| NMP                             | 5%                        |
| Solvent and non-solvent methods | 90%                       |
| Total                           | 100%                      |

If DCM were banned in this sector, IRTA estimated that 95% of the operations would convert to other solvents and water-based materials as shown in Table 4-2 below.

**Table 4-2  
Estimates of Conversion to Alternatives in Art Restoration and Conservation Assuming DCM and NMP Bans**

| <b>Stripping Technology</b>              | <b>Percent Conversion</b> |
|--|---------------------------|
| Other solvents and water-based materials | 95%                       |
| Media blasting or sanding                | 5%                        |
| Total                                    | 100%                      |

If NMP were still available, perhaps some of the DCM users would convert to NMP based materials. The estimates, if NMP were still available for the conversion are shown in Table 4-3. The values show that perhaps 20% of the DCM stripping would be converted to NMP strippers. The balance would be converted to other methods.

**Table 4-3  
Estimates of Conversion to Alternatives in Art Restoration and Conservation Assuming a DCM Only ban**

| <b>Stripping Technology</b> | <b>Percent Conversion</b> |
|-----------------------------|---------------------------|
|-----------------------------|---------------------------|

|  |      |
|--|------|
| NMP strippers                            | 20%  |
| Other solvents and water-based materials | 75%  |
| Media blasting or sanding                | 5%   |
| Total                                    | 100% |

## 5. Automotive Refinishing

In the earlier memo, IRTA classified this sector into four different subsectors. The first is autobody repair and refinishing which includes companies that repair and paint vehicles of all kinds. The second is aftermarket refinishing where companies or consumers strip and paint older vehicles. The third is wheel stripping which is performed by separate companies that strip and refinish vehicle wheels. The fourth is ground vehicle repair and painting which is largely performed by military operations or their contractors. The possibility of using NMP strippers in each subsector is considered below.

### 5.1. Autobody Repair and Refinishing

As discussed in the earlier memo, autobody shops which repair and refinish cars do not use paint strippers routinely. Rather they may replace whole parts (like fenders or bumpers, for instance) or they knock out the damage, hand sand it and paint it to match the rest of the paint job. In certain cases, the technician may use a stripper and is likely to purchase it from a big box store.

Hand sanding of damaged vehicle parts or of whole vehicles is an alternative to DCM paint strippers in this sector. Media blasting could be an alternative for very large repair shops or shops that paint large parts of vehicles where the cost of a system would be justified. Alternative chemical strippers, based on either benzyl alcohol or NMP could also be used. NMP might take longer to work but it could be supplemented by hand sanding.

Chemical strippers are only used to a small extent in this sector today. In IRTA's earlier memo, only 5% of the stripping was estimated to be performed with chemical strippers. Of this 5%, IRTA estimated that adoption of the alternatives in the event that both DCM and NMP were banned would be apportioned as shown in Table 5-1.

**Table 5-1**  
**Estimates of Conversion to Alternatives in Auto-**  
**motive Repair Assuming DCM and NMP Bans**

| <b>Stripping Technology</b> | <b>Percent Conversion</b> |
|-----------------------------|---------------------------|
| Benzyl alcohol strippers    | 50%                       |
| Hand/power sanding          | 45%                       |
| Media blasting              | 5%                        |
| Total                       | 100%                      |

If DCM were banned and NMP was still available, those technicians using chemical strippers would likely continue to do so. Some of them would use benzyl alcohol strippers and some would use NMP strippers. It's worth noting here (and elsewhere in this memo) that the analysis assumes that consumer product strippers at big box stores based on benzyl alcohol would be available. Those using strippers in

autobody shops would most likely purchase their strippers there. They would purchase whatever strippers were on the shelf and would not necessarily be discerning. Since NMP is not a very good alternative and would likely take longer, some technicians might realize that benzyl alcohol strippers work somewhat more quickly. The conversion percentages to hand or power sanding and media blasting would remain the same. Table 5-2 shows IRTA’s estimates of the percent conversions assuming NMP is not banned.

**Table 5-2**  
**Estimates of Conversion to Alternatives in Auto-**  
**otive Repair Assuming a DCM Only Ban**

| <b>Stripping Technology</b> | <b>Percent Conversion</b> |
|-----------------------------|---------------------------|
| Benzyl alcohol strippers    | 30%                       |
| NMP strippers               | 20%                       |
| Hand/power sanding          | 45%                       |
| Media blasting              | 5%                        |
| Total                       | 100%                      |

## 5.2 Aftermarket Refinishing

In this subsector, companies or consumers might strip whole vehicles, generally older ones, and repaint them. Some of these may be stripped as part of antique or custom restorations. In the earlier memo, IRTA estimated that chemical strippers accounted for about 80% of the stripping currently performed in the subsector. DCM strippers accounted for 75%. ATM, NMP and benzyl alcohol strippers accounted for 5%. The estimates are shown in Table 5-3 below.

**Table 5-3**  
**Estimates of Stripping Methods Used in**  
**Aftermarket Refinishing**

| <b>Stripping Technology</b>          | <b>Percent Used</b> |
|--------------------------------------|---------------------|
| DCM strippers                        | 75%                 |
| ATM, NMP or benzyl alcohol strippers | 5%                  |
| Hand/power sanding                   | 17%                 |
| Other (primarily media blasting)     | 3%                  |
| Total                                | 100%                |

Under the assumption that both DCM and NMP would be banned, IRTA’s earlier estimates of the chosen alternatives are shown in Table 5-4 below. Some of these using DCM and NMP would convert to alternative chemical strippers like benzyl alcohol and ATM strippers. Others would convert to abrasive methods.

**Table 5-4**  
**Estimates of Conversion to Alternatives in After-**  
**market Refinishing Assuming DCM and NMP Bans**

| Stripping Technology     | Percent Conversion |
|--------------------------|--------------------|
| Benzyl alcohol strippers | 50%                |
| ATM strippers            | 30%                |
| Hand/power sanding       | 15%                |
| Other technologies       | 5%                 |
| Total                    | 100%               |

If NMP were not banned and it was still available, IRTA estimates that part of the market would convert to NMP strippers. The estimates are shown in Table 5-5 below.

**Table 5-5  
Estimates of Conversion to Alternatives in After-market Refinishing Assuming a DCM Only Ban**

| Stripping Technology     | Percent Conversion |
|--------------------------|--------------------|
| Benzyl alcohol strippers | 30%                |
| NMP strippers            | 25%                |
| ATM strippers            | 25%                |
| Hand/power sanding       | 15%                |
| Other technologies       | 5%                 |
| Total                    | 100%               |

### 5.3 Wheel Stripping

The wheels that are stripped are generally made of aluminum and the coatings are commonly removed by immersing them in DCM stripping formulations. In the earlier memo, IRTA estimated that 90% of the stripping was performed with DCM chemical strippers. IRTA estimated that the remaining 10% were stripped with benzyl alcohol strippers and that these were probably used only in instances where DCM strippers have been banned or restricted. Benzyl alcohol strippers do work but more slowly than DCM strippers. Abrasive methods are not practical because of the configuration of the wheels.

Of the 90% of the stripping currently performed with DCM strippers, IRTA estimated that 95% would convert to benzyl alcohol strippers in the earlier memo. IRTA estimated that 5% might be able to use hand sanding or media blasting where the wheels had an accessible configuration. The earlier memo assumed a ban on both DCM and NMP. The situation would not change, however, if NMP were still available. NMP formulations are not effective for stripping the coatings used on wheels so users would not convert to them. NMP strippers might eventually strip the coatings but would take too long to be viable. Table 5-6 below shows the estimates of the alternatives which are the same for a ban on DCM and NMP or just a ban on DCM strippers.

**Table 5-6  
Estimates of Conversion to Alternatives in Wheel Stripping for DCM and NMP Ban or DCM Only Ban**

| Stripping Technology | Percent |
|----------------------|---------|
|----------------------|---------|

|                                      | <b>Conversion</b> |
|--------------------------------------|-------------------|
| Benzyl alcohol strippers             | 95%               |
| Hand/power sanding or media blasting | 5%                |
| Total                                | 100%              |

#### 5.4 Ground Vehicle Stripping

Ground vehicle stripping is generally performed by the army or other arms of the service or their subcontractors at military bases. Military ground vehicles generally contain CARC paint which is composed of an epoxy primer and a CARC polyurethane topcoat. Vehicle parts may have coatings and sealants of other types on some of their parts. Although the vehicles are generally stripped using media blasting systems of various kinds, DCM strippers are likely also used for touchup stripping and possibly in immersion systems for certain parts. In the earlier memo, IRTA estimated that 90% of the stripping in this subsector was performed with blasting technologies and the remaining 10% was performed with DCM strippers.

NMP strippers would not be effective for stripping the types of coatings used on ground vehicles. In the earlier memo, IRTA estimated that, of the 10% of the stripping done with DCM, all of it would be converted to benzyl alcohol strippers. If NMP were still available, the situation would not change. Table 5-7 shows the estimates of the conversion under a DCM and NMP ban or a DCM only ban.

**Table 5-7**

**Estimates of Conversion to Alternatives in Ground Vehicle Maintenance for DCM and NMP ban or DCM Only Ban**

| <b>Stripping Technology</b> | <b>Percent Conversion</b> |
|-----------------------------|---------------------------|
| Benzyl alcohol strippers    | 100%                      |
| Total                       | 100%                      |

#### 6 Bathtub Refinishing

As discussed in the earlier memo, the most widely used chemical stripper today in this sector is DCM. During preparation for painting, hand sanding is often also used as a supplementary option. NMP strippers can be used for bathtub stripping with certain types of coatings but not for others. More recently, benzyl alcohol strippers are starting to be used more widely. Hand sanding, by itself, is also an option used in this sector. Much of the stripping/refinishing work in this sector is done by small contractors. In some cases, homeowners may do the work themselves with consumer product paint strippers they purchase at big box stores.

Table 6-1 shows the estimates of the stripping methods used in this sector from the earlier memo. Because of the publicity over the deaths from DCM, some companies have started converting to benzyl alcohol.

**Table 6-1**

**Estimates of Stripping Methods Used in Bathtub Refinishing**

| <b>Stripping Technology</b> | <b>Percent Used</b> |
|-----------------------------|---------------------|
| DCM strippers               | 85%                 |
| Benzyl alcohol strippers    | 5%                  |
| Hand/power sanding          | 10%                 |
| Total                       | 100%                |

In the earlier memo, IRTA estimated that, if DCM and NMP were both banned, all of the DCM would be converted to benzyl alcohol. Hand or power sanding would still account for 10%. Table 6-2 shows the estimates.

**Table 6-2**  
**Estimates of Conversion to Alternatives in Bathtub Refinishing Assuming DCM and NMP Bans**

| <b>Stripping Technology</b>          | <b>Percent Conversion</b> |
|--------------------------------------|---------------------------|
| Benzyl alcohol strippers             | 90%                       |
| Hand/power sanding or media blasting | 10%                       |
| Total                                | 100%                      |

Since NMP could be effective on some of the coatings used in the sector, if it were not banned, some contractors or homeowners would likely use it. Table 6-3 shows the estimates of the alternatives in the event that DCM but not NMP was banned.

**Table 6-3**  
**Estimates of Conversion to Alternatives in Bathtub Refinishing Assuming DCM Only Ban**

| <b>Stripping Technology</b>          | <b>Percent Conversion</b> |
|--------------------------------------|---------------------------|
| Benzyl alcohol strippers             | 70%                       |
| NMP strippers                        | 20%                       |
| Hand/power sanding or media blasting | 10%                       |
| Total                                | 100%                      |

## 7 Furniture Refinishing

This sector is composed of numerous very small companies with one or two employees and larger (but still small) operations that might have 5 to 20 employees. The smaller companies, who repair old and sometimes antique furniture do not use equipment but rather do the stripping necessary by hand with strippers they purchase from big box stores. The larger companies have equipment, flow trays and water wash booths, for stripping larger volumes of items. Often, they also have coating booths for refinishing the furniture. Some of the larger companies also have dip tanks where they put hard to strip items and/or items with multiple coatings, like doors, for example, for a period to loosen the paint. They then transfer them to the flow tray for final stripping. These larger companies most often purchase their strippers from distributors in larger quantities.

Virtually all furniture strippers use DCM based strippers today. In a few cases, stripping firms may use other strippers, usually NMP, if agencies in the area have restricted the use of DCM. A few furniture stripping firms use caustic dip tank strippers in cases where they process certain types of wood dominantly. For the most part, although hand sanding is a supplementary method used by all furniture strippers, chemical strippers are used for the bulk of the work. Table 7-1 summarizes the estimates of which technologies are used in this sector from the earlier memo.

**Table 7-1**  
**Estimates of Stripping Methods Used in**  
**Furniture Refinishing**

| <b>Stripping Technology</b>        | <b>Percent Used</b> |
|------------------------------------|---------------------|
| DCM strippers                      | 90%                 |
| NMP strippers                      | 4%                  |
| Benzyl alcohol strippers           | 1%                  |
| Caustic strippers and hand sanding | 5%                  |
| Total                              | 100%                |

IRTA contacted a stripper who converted from DCM to NMP about a year ago. He was required to stop using DCM because he had to move to a new location. He indicated that he has had to change his business significantly to account for the change. In the past, the company had a large dip tank where doors with heavy and multiple coatings were immersed to loosen the coatings. He no longer has a dip tank and does not take doors or large tables because NMP cannot strip the coatings. With the NMP, he is able to strip varnishes, lacquers and urethanes but cannot strip what he refers to as paint. The NMP also takes longer. He still takes in kitchen cabinets and strips them at user sites. He sometimes uses NMP for this in his shop but it takes longer. He uses DCM hand strippers he purchases at big box stores to supplement the NMP, particularly on the kitchen cabinet components which often have latex and oil based paints that require stripping. The stripper did not want to purchase new equipment, although IRTA told him about that option at the time of the move. Benzyl alcohol would work more effectively than NMP because it would strip more types of paint but he still would have likely had to eliminate the dip tank stripping.

Table 7-2 shows the estimates IRTA made in the earlier memo of the alternatives strippers would convert to if only DCM were banned or if both DCM and NMP were banned. IRTA does believe that most companies would convert to NMP because they would want to avoid purchasing new equipment even though it is not that costly. Benzyl alcohol strippers could strip more types of coatings encountered in this sector and would be a better option but the new equipment cost would still deter them from using it. If NMP were banned as well as DCM, nearly all strippers would convert to benzyl alcohol strippers. They would likely be able to strip more types of coatings if both DCM and NMP were banned.

**Table 7-2**  
**Estimates of Conversion to Alternatives in**  
**Furniture Refinishing**

| <b>Stripping Technology</b> | <b>Percent Conversion if DCM</b> | <b>Percent Conversion if DCM</b> |
|-----------------------------|----------------------------------|----------------------------------|
|-----------------------------|----------------------------------|----------------------------------|

|                          | <b>Were Banned</b> | <b>and NMP Were Banned</b> |
|--------------------------|--------------------|----------------------------|
| NMP strippers            | 90%                | NA                         |
| Benzyl alcohol strippers | 5%                 | 95%                        |
| Hand sanding             | 5%                 | 5%                         |
| Total                    | 100%               | 100%                       |

NA is not applicable.

## 8 Professional Contractors

As discussed in the earlier memo, IRTA did not evaluate this category for alternatives because it is so diverse and some of the activities are covered under other sectors. Many professional contractors purchase strippers at big box stores or from distribution companies. If DCM were banned and NMP was still available, contractors would certainly use NMP. They, like workers in many of the other sectors and subsectors, would simply purchase whatever strippers are on the shelves of big box stores. Again, as discussed earlier, it would be important for suppliers to start providing benzyl alcohol strippers to consumer product stripper outlets.

## 9 Pleasure Craft Paint Stripping

As discussed in the earlier memo, large ships are not stripped with chemical strippers. Pleasure craft, which are made of fiberglass or wood, are stripped with DCM strippers or are sanded. The Navy also has a lot of smaller boats that may be made of fiberglass or metal and they are generally stripped using the same methods. The types of coatings used in this sector on boat hulls are epoxy primers and most often copper antifouling topcoats. The topcoats have a very high percentage of solids, generally more than 50%. Most of the larger pleasure craft are stripped in boatyards but smaller boats may be stripped by the owners. The DCM strippers that are used are often purchased at marine supply stores or big box stores. A few boatyards may strip with blasting technologies and some boat owners may use heat guns to some extent. In the earlier memo, IRTA estimated the current stripping methods as shown in Table 9-1.

**Table 9-1**  
**Estimates of Stripping Methods Used in**  
**Pleasure Craft Stripping**

| <b>Stripping Technology</b> | <b>Percent Used</b> |
|-----------------------------|---------------------|
| DCM strippers               | 50%                 |
| Hand/power sanding          | 40%                 |
| Media Blasting              | 5%                  |
| Heat tools                  | 5%                  |
| Total                       | 100%                |

IRTA has not tested either benzyl alcohol or NMP strippers in this sector. Both strippers could probably strip the coatings but they would be slower than DCM. Benzyl alcohol strippers would likely work more effectively than NMP strippers. Assuming the ban on both DCM and NMP in the earlier memo, IRTA made the estimates shown in Table 9-2. If DCM were banned, perhaps 45% of the DCM stripping would

be converted to benzyl alcohol strippers and 45% would be converted to hand/power sanding. The remaining 10% would be converted to media blasting or heat tools, with 5% going to each.

**Table 9-2**  
**Estimates of Conversion to Alternatives in Pleasure Craft Stripping Assuming DCM and NMP Bans**

| Stripping Technology     | Percent Conversion |
|--------------------------|--------------------|
| Benzyl alcohol strippers | 45%                |
| Hand/power sanding       | 45%                |
| Media blasting           | 5%                 |
| Heat tools               | 5%                 |
| Total                    | 100%               |

If NMP strippers were available, some of the DCM market would convert to these strippers instead of benzyl alcohol. Table 9-3 shows the estimates under the assumption that DCM only is banned. As the figures indicate, more users would convert to benzyl alcohol than to NMP.

**Table 9-3**  
**Estimates of Conversion to Alternatives in Pleasure Craft Stripping Assuming DCM Only Ban**

| Stripping Technology     | Percent Conversion |
|--------------------------|--------------------|
| Benzyl alcohol strippers | 30%                |
| NMP strippers            | 15%                |
| Hand/power sanding       | 45%                |
| Media blasting           | 5%                 |
| Heat tools               | 5%                 |
| Total                    | 100%               |

## 10 Graffiti Removal

Graffiti removal is very eclectic and many different technologies, including chemical graffiti removers, are used to remove spray paint, stickers, marker and other types of graffiti from various surfaces. Most often painting over is used and other techniques, like blasting methods, film and graffiti resistant coating surface protection are also used. Graffiti removal of spray paint is much easier in this sector than for cured paint removal in the other sectors discussed here because simple solventborne spray paint is used. As a result, many different types of chemicals can be effective for removing spray paint. In the earlier memo, IRTA made estimates of the different types of graffiti removers used today. These estimates are shown in table 10-1 below.

**Table 10-1**  
**Estimates of Graffiti Remover Types Used in Graffiti Removal**

| Stripping Technology    | Percent Used |
|-------------------------|--------------|
| DCM removers            | 5%           |
| NMP removers            | 50%          |
| Other chemical removers | 45%          |
| Total                   | 100%         |

In the earlier memo, IRTA estimated that, of the chemical strippers used, if DCM and NMP were both banned, the bulk of the market, 90%, would convert to other chemical strippers. The conversion estimates, if both DCM and NMP were banned, are shown in Table 10-2.

**Table 10-2**  
**Estimates of Conversion to Alternatives in Graffiti**  
**Removal Assuming DCM and NMP Bans**

| Graffiti Management Technology | Percent Conversion |
|--------------------------------|--------------------|
| Other chemical removers        | 90%                |
| Media blasting                 | 8%                 |
| Other                          | 2%                 |
| Total                          | 100%               |

If NMP were not banned, it would be available for use in graffiti removers for applications where DCM is used today. Table 10-3 shows the estimates of the conversion alternatives if DCM graffiti removers were banned. The values show that about 50% of the DCM removers would be converted to NMP removers.

**Table 10-2**  
**Estimates of Conversion to Alternatives in**  
**Graffiti Removal Assuming DCM Only Ban**

| Graffiti Management Technology | Percent Conversion |
|--------------------------------|--------------------|
| NMP removers                   | 50%                |
| Other chemical removers        | 40%                |
| Media blasting                 | 8%                 |
| Other                          | 2%                 |
| Total                          | 100%               |

## 10 Other

IRTA discussed two other applications in the earlier memo that were not covered in the analysis. The first is consumers who strip at home. They strip wood coatings and metal coatings and use graffiti removers for various tasks. Consumer product strippers are sold at big box stores, hardware stores and on-line. If DCM were banned, almost the whole market would be converted to NMP strippers because they are already on the market. These NMP strippers would take a significant period of time to strip many types of coatings and they might not be able to strip others at all. Consumers do not have time constraints like businesses, however, so this might be acceptable. There are very few benzyl alcohol

strippers on the market and at least one also contains NMP. If DCM and NMP were both banned, suppliers would begin developing and marketing benzyl alcohol strippers and these would be available for consumers and other small businesses who purchase strippers from these sources. Benzyl alcohol strippers would also probably take somewhat longer than DCM to strip but they would be able to strip more coatings than NMP based strippers. If DCM or DCM and NMP consumer product graffiti removers were banned, consumers would convert to other graffiti removers that are already on the market.

The second category of user is the companies that need to rework parts. In many cases, if the part is reworked before the paint is cured, almost any solvent could remove the coating readily. For cured paint, a variety of methods could be used. Many companies simply purchase whatever strippers are sold at big box stores and, depending on whether DCM or DCM and NMP are banned, they would purchase the alternative strippers that are on the shelf. Presumably, more benzyl alcohol strippers would be available if bans were enacted.