His Majesty Sultan Qaboos Bin Said

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ملخص تنفيـذي
لخطة التطبيق الوطني لاتفاقية استوكهولم
بشأن الملوثات العضوية الثابتة

مقدمــة :

تعرف الملوثات العضوية الثابتة، بصرف النظر عن سُميتها وتطايرها وتحللها وتراكمها في الكائنات الحية، بمقدرتها على تجاوز الحدود الوطنية، وهذا يعتبر بمثابة العامل الرئيس الذي فرض القرار الخاص باتخاذ إجراء مشترك على المستوى الدولي لإيجاد حلول مشتركة للمشاكل المرتبطة بإنتاج واستيراد وتصدير ونقل وتوزيع واستخدام وتخزين والتخلص من المواد ال (١٢) الواردة في قائمة هذه المجموعة من المواد الكيميائية، ووفقاً للأدلة الواضحة التي لا جدال فيها عن التأثيرات السلبية للملوثات العضوية الثابتة على صحة البشر والبيئة، فقد تم إقرار كل من بروتوكول الملوثات العضوية الثابتة لاتفاقية التلوث بعيد المدى للهواء عبر الحدود (١٩٩٨) واتفاقية استكهولم بشأن الملوثات العضوية الثابتة، وبالاتحاد مع الأطراف الموقعة والأطراف الأخرى فقد أصبحت سلطنة عُمان طرفا في اتفاقية استكهولم بشأن الملوثات العضوية الثابتة في عام ٢٠٠٥، وموافقة على متطلبات إعداد خطة للإيفاء بالتزامات الاتفاقية وإنشاء الآلية الضرورية لإعداد خطة التنفيذ الوطنية بدعم كريم من برنامج الأمم المتحدة للبيئة ومرفق البيئة العالمي الخاص بالتمويل وبناء قدرات الأنشطة التمكينية لتقوية عملية إعداد خطة التنفيذ الوطنية.

الهدف:

إن الهدف الرئيسي من خطة التنفيذ الوطنية هو تقييم مدى انتشار الملوثات العضوية الثابتة في السلطنة والمواضيع المتعلقة بها والتعرف على المشاكل المرتبطة بها وتقديم إجراءات واضحة واستراتيجيات للتعامل معها وفقاً للأهداف والأولويات الوطنية وبما يتفق مع التزامات السلطنة باتفاقية استكهولم.

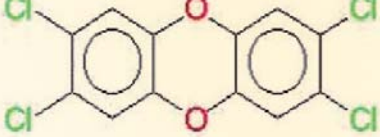
طريقة التنفيذ:

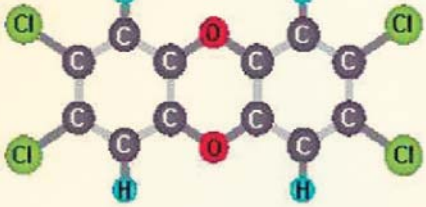
وفقاً لفلسفة الحماية البيئية للسلطنة، تقع إدارة المواد الكيميائية بصفة عامة ضمن نطاق مسئوليات وزارة البيئة والشئون المناخية، ومع ذلك واعترافاً بمشاركة الجهات الحكومية وغير الحكومية في تداول المواد الكيميائية فقد أصبح من الضروري التطرق إلى مهمة إعداد خطة التنفيذ الوطنية بطريقة متعددة القطاعات وفيما بين الوزارات، عليه و بما أن وزارة البيئة والشئون المناخية جهة تنسيقية رئيسية فقد تم عقد اجتماع للجنة المكونة من الخبراء في الدوائر ذات الصلة بتداول المواد الكيميائية في المؤسسات ذات المصلحة وذلك كخطوة أولى، ومن ثم تم تشكيل فرق عمل منها وعقد مجموعة من ورش العمل لتقدم التدريب والتوضيح والإرشادات الخاصة بالإجراء التدريجي للإعداد النهائي لخطة التنفيذ الوطنية.

إطار خطة التنفيذ الوطنية:

بناءً على المراجع ذات الصلة وتحليل البيانات من مختلف المصادر وعلى وجه الخصوص قوائم الحصر وقواعد البيانات فإن خطة التنفيذ الوطنية لسلطنة عُمان هي تقرير شامل حول مختلف الجوانب المتعلقة بإدارة الملوثات العضوية الثابتة بحسب ما ورد وصفها في اتفاقية استكهولم، حيث تبدأ بإلقاء نظرة شاملة عن المنظور الوطني للسلطنة بإشارة خاصة لمواضيع ومشاكل الملوثات العضوية الثابتة وإيراد وصف للإطار التنظيمي والمؤسسي الحالي الموجه لإدارة الملوثات العضوية الثابتة في السلطنة.

تقوم خطة التنفيذ الوطنية، فيما يتعلق ببعض الالتزامات الدولية للأطراف في اتفاقية استكهولم، بتقييم المواضيع المتعلقة بالملوثات العضوية الثابتة في عُمان وتورد باختصار الاستراتيجيات وخطط العمل الخاصة بالتعامل معها بما في ذلك آخر مواعيد للأهداف المحددة وتقديرات الموارد المطلوبة، وبنظرة سريعة للتقرير تتضح النقاط التالية:





مبيدات الملوثات العضوية الثابتة

وضع الدولة :

إن مبيدات الملوثات العضوية الثابتة المحظورة بموجب اتفاقية استكهولم، نتيجة لوضعها تحت مسئولية وزارة البيئة والشئون المناخية ووزارة الزراعة ، هي محظورة أيضاً في السلطنة، وقد أتضح من قائمة الجرد لمبيدات الملوثات العضوية الثابتة في كافة أرجاء الدولة الذي قام بها فريق عمل المبيدات خلال عملية دراسة خطة التنفيذ الوطنية للسلطنة وكذلك كتفتيش مبكر لأسواق المبيدات من ٢٠٠١-٢٠٠٣ إتضح عدم وجود مخزون من المبيدات المنتهية أو مواقع ملوثة في السلطنة، كما أنه علاوة على ذلك ليس هناك أي دليل على استخدام مبيدات الملوثات العضوية الثابتة المحظورة في السابق، وقد يكون ذلك نظراً لأن الزراعة في السلطنة قبل الثمانينيات كانت تمارس في معظمها باستخدام طرق الزراعة التقليدية كما أن الأراضي الزراعية في ذلك الوقت كانت محدودة. وقد تم نشر التوعية بمبيدات الملوثات العضوية الثابتة عن طريق مختلف وسائل الإعلام، مع ذلك هناك بعض الاهتمامات والتوصيات المتعلقة بالاستخدام الحالي لمبيدات الملوثات العضوية الثابتة بصفة عامة.

المشاكل التي تم تحديدها :

- عدم وجود دراسات عن تقييم التأثيرات البيئية والصحية للاستخدامات السابقة للمبيدات.
- تضليل قوائم البيانات.
- عدم توفر بيانات حول بقايا الكيماويات في الأغذية.
- عدم وجود معلومات تفصيلية عن الاستخدامات والتصريفات السابقة لمبيدات الملوثات العضوية الثابتة.
- تهريب المبيدات.
- عدم وعي افراد المجتمع عن استخدام الملوثات العضوية الثابتة في السابق وتأثيراتها المحتملة.

الإجـراء	الإطـار الزمنـي
تحسين النظام التنظيمي للمبيدات	٢٠٠٩-٢٠١٣
التأكد من أن المواد الغذائية المستوردة والمحلية المنتجة خالية من بقايا الملوثات العضوية الثابتة	٢٠٠٩-٢٠١٣
التأكد من أن المبيدات المستوردة ملتزمة بالتشريعات الدولية والوطنية	٢٠٠٧-٢٠١٠
تحديد المواقع والكميات المستخدمة وتركيز بقايا مبيد د. د. ت المستخدم في السابق ومبيدات الملوثات العضوية الثابتة	٢٠٠٩-٢٠١٢
تقييم المخاطر نتيجة للاستخدامات السابقة لمبيدات الملوثات العضوية الثابتة خاصة ال د. د. ت	٢٠٠٩-٢٠١٤
تحديد المواقع الملائمة والآليات الخاصة بالتخلص من مبيدات الملوثات العضوية الثابتة	٢٠٠٩-٢٠١٤
زيادة الوعي حول المخاطر الصحية المحتملة وتأثيرات بقايا استخدام المبيدات بين عمال الرعاية الصحية	٢٠٠٩-٢٠٢٥
زيادة التوعية العامة حول التأثيرات المحتملة والإدارة السليمة للمبيدات	٢٠٠٩-٢٠٢٥

مركبات ثنائي الفينيل متعدد الكلور:

وضع الدولة :

تحظر مركبات ثنائي الفينيل متعدد الكلور في سلطنة عُمان بموجب نظام تداول واستخدام الكيميائيات الصادر بالمرسوم السلطاني رقم (٩٥/٤٦) والقرار الوزاري رقم (٢٠٠١/٣١٦) الذي يستهدف مواد كيميائية معينة، ومع ذلك بما أن هذه اللائحة تتعلق بالاستخدام المباشر لمركبات ثنائي الفينيل متعدد الكلور فقط دون التطرق لمركبات ثنائي الفينيل متعدد الكلور المحتوية في معدات محكمة مستخدمة على وجه الخصوص المكثفات والمحولات، فإن الأمر تتطلب عمل حصر وطني لمركبات ثنائي الفينيل

متعدد الكلور على عينة من المحولات لتغطي المتغيرات مثل سنة الصنع (قبل وبعد عام ١٩٩٠) ونوع المحول (توليد ونقل وتوزيع) ونوع المالك (وزارة أو شركة)، وقد إتضح أن من بين ١٤٣ محول تم جردها هناك ٣٦ أو ٢٦٪ فقط يفترض أنها ملوثة بمركبات ثنائي الفينيل متعدد الكلور (بناءً على قواعد افتراض معيارية لثنائي الفينيل متعدد الكلور) وأن غالبيتها من تلك التي تم تصنيعها قبل عام ١٩٩٠، وهناك كمية محدودة من المحولات التي تحتوي على زيت مركبات ثنائي الفينيل متعدد الكلور النقي في السلطنة، حيث بلغ متوسط عمر العينة من المحولات ١٣ سنة، كما أن غالبيتها قد تم استيرادها قبل فرض الحظر على مركبات ثنائي الفينيل متعدد الكلور في عام ١٩٩٠، ويعتقد أن عمليات الصيانة قد تسببت في التلوث، كما أوضح الحصر أن ٢٥٤ محول وضعت عليها بيانات توضح بأن نسبة الكثافة أعلى من ٠,٣٥، وعادة ما يؤدى ذلك إلى الافتراض بأنه قد تم تصميمها وتصنيعها كمحولات لمركبات ثنائي الفينيل متعدد الكلور، وعلى كل فإن ذلك يتطلب إجراء اختبار دقيق لتحديد ما إذا كانت مليئة بالفعل بزيت مركبات ثنائي الفينيل متعدد الكلور أو تم استبداله بزيت معدني.

المشاكل التي تم تحديدها:

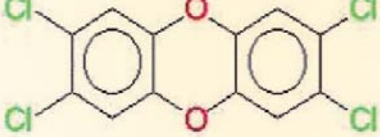
- لا يوجد نظام معمول به وذلك فيما يخص التخلص التدريجي من المعدات المحتوية على مركبات ثنائي الفينيل متعدد الكلور.
- قاعدة البيانات للمحولات غير مكتملة (تحتاج إلي تأكيد وتقدير لمحتوى مركبات ثنائي الفينيل متعدد الكلور في المحولات المفترض احتوائها على مركبات ثنائي الفينيل متعدد الكلور).
- عدم وجود قدرة مختبرية لتحليل مركبات ثنائي الفينيل متعدد الكلور لتأكيد التلوث المفترض بمركبات ثنائي الفينيل متعدد الكلور وتقدير المحتوى الصحيح لمركبات ثنائي الفينيل متعدد الكلور.
- لا يوجد نظام معمول به لرصد المحولات المحتوية على مركبات ثنائي الفينيل متعدد الكلور.
- عدم وجود معرفة تتعلق بمشاكل مركبات ثنائي الفينيل متعدد الكلور.
- لا يوجد نظام للتخلص البيئي السليم من المخلفات الخطرة بما في ذلك مركبات ثنائي الفينيل متعدد الكلور.
- لم يتم اتخاذ إجراءات وقائية لتفادي التلوث بالمحولات المحتوية على مركبات ثنائي الفينيل متعدد الكلور.
- موارد بشرية محدودة في مجال زيادة الوعي بالمواضيع المتعلقة بمركبات ثنائي الفينيل متعدد الكلور.
- ضعف التنسيق بين مختلف الجهات والقطاع العام.
- مشاركة محدودة للجمهور في صنع القرارات.

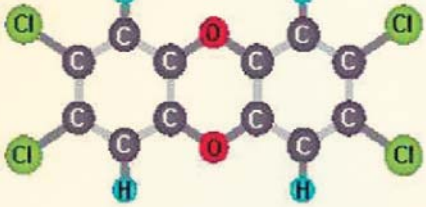
الإجـراء	الإطـار الزمنـي
• تقوية وتنفيذ التشريعات الخاصة بإدارة مركبات ثنائي الفينيل متعدد الكلور	٢٠٠٨-٢٠١٤
• إعداد إجراءات خاصة بصيانة معدات مركبات ثنائي الفينيل متعددالكلور	٢٠٠٩-٢٠١٣
• إنشاء مختبر مؤهل لتحليل مركبات ثنائي الفينيل متعددالكلور	٢٠٠٩-٢٠١٢
• إعداد إرشادات شاملة خاصة باستخدام ووضع بطاقات وتخزين ونقل والتخلص التدريجي والتخلص من المعدات المحتوية على مركبات ثنائي الفينيل متعدد الكلور	٢٠٠٩-٢٠٢٥
• إنشاء فرق من الجهات المعنية لتفتيش وإدارة معدات ثنائي الفينيل متعدد الكلور	٢٠٠٩-٢٠١٣
• التخلص التدريجي من معدات مركبات ثنائي الفينيل متعددالكلور	٢٠٠٨-٢٠٢٥
• إزالة التلوث وإعادة تأهيل المواقع الملوثة	٢٠١٠-٢٠١٥

مبيـد د. د. ت:

وضع الدولة:

لقد تم استخدام ما إجماله ١٣٧٠٣٤ كيلوجراما من مبيد د. د. ت لأغراض مكافحة الملاريا عن طريق الرش في بعض القرى المختارة في ٢٨ ولاية في مختلف مناطق السلطنة في الفترة ما بين ١٩٧٦-١٩٩٢، ومع ذلك لم يستخدم مبيد د. د. ت أبداً لمكافحة





الآفات أو تم تطبيقه في الهواء الطلق لاستئصال الملاريا.

وإيفاءً لالتزامات السلطنة في الاتفاقيات الدولية (استكهولم وبازل وروتردام) التي هي طرف فيها والتي تتطرق إلي الكيماويات، فقد تم تصنيف مبيد د. د. ت من بين المواد الكيميائية التي ينظمها المرسوم السلطاني رقم (٩٥/٤٦). بالإضافة إلي ذلك فقد قامت وزارة البيئة والشئون المناخية بإصدار بعض القرارات الوزارية للحماية من مخاطر المواد الكيميائية، فبينما القرار الوزاري رقم (٢٠٠١/٣١٧) بإصدار لائحة شروط التعبئة والتغليف ووضع البيانات والملصقات للمواد الكيميائية الخطرة، والقرار الوزاري رقم (٩٧/٢٤٨) يتعلق بتسجيل مثل هذه المواد الكيميائية نجد بأن القرار الوزاري (٢٠٠١/٣١٦) يحظر مبيد د. د. ت في عُمان. علاوة على ذلك فقد أصدرت المديرية العامة للدفاع المدني التابعة لشرطة عُمان السلطانية إرشادات حول التخزين والنقل الآمن للكيماويات الخطرة بما في ذلك مبيد د. د. ت، ومنذ عام ١٩٩٢ تم حظر مبيد د. د. ت في عُمان باستثناء الفترة بين ١٩٩٤-١٩٩٨ حيث يتم تطبيقه بين الفينة والفينة في حالات منفصلة لمكافحة الذبابة الرملية، وقد تم إيقاف د. د. ت تماماً واستبداله بالفوسفات العضوية ومبيد الحشرات الاصطناعي (pyrethroids). ولا يوجد في الوقت الحاضر مخزون منه كما لم يتم استيراد أي كمية منه للبلاد منذ عام١٩٩٨.

المشاكل التي تم تحديدها:

- عدم وجود دراسات حول تأثير الاستخدامات السابقة لمبيد د. د. ت على البيئة والصحة.
- عدم وجود توعية بتأثير المتبقيات المحتملة نتيجة للتعرض لمبيد د. د. ت بين عمال الصحة.
- عدم وجود بيانات حول البقايا المحتملة في الأغذية المستوردة والمنتجة محلياً.
- عدم وجود توعية عامة حول التأثيرات الصحية المحتملة للاستخدامات السابقة لمبيد د. د. ت.

الإجـراء	الإطـار الزمنـي
• إجراء تقييم بيئي وتقييم للمخاطر الصحية الناجمة عن الاستخدامات السابقة لمبيد د. د. ت	٢٠٠٥-٢٠١٠
• التأكد من أن المواد الغذائيـة المستوردة والمنتجـة محلياً خالية من بقايا الملوثات العضوية الثابتة	٢٠٠٧-٢٠١٠
• زيادة الوعي بين عمال الصحة حول التأثيرات المحتملة والتأثيرات المتخلفة من مبيدات الملوثات العضوية الثابتة	٢٠٠٧-٢٠٢٥

المنتجات الثانوية للملوثات العضوية الثابتة المنتجة بطريقة غير متعمدة:

وضع الدولة:

يعتبر الحرق المفتوح للمخلفات ومحارق المخلفات الطبية أحد أهم مصادر التعرض المحتمل الرئيسي والتي يمكن أن يكون لها تأثيرات سلبية على السكان المقيمين في المناطق المجاورة، وتتضمن المصادر الأخرى المحتملة الناجم عنها إطلاق للمنتجات الثانوية للملوثات العضوية الثابتة المنتجة بطريقة غير متعمدة كل من مصافي النفط وصناعات المعادن ومحارق الجثث وتوليد الطاقة بالديزل، غير أن هذه لا تعتبر بأن لها تأثير مباشر على صحة البشر في السلطنة، وقد تم التعرف في دول منطقة الخليج على أن إطلاق الدايوكسينات والفيورانات ينجم عن مصانع الألمنيوم والكلور والقلوي ومصانع الكلوريد متعدد الفينيل ومصافي النفط وصناعة الفولاذ ومحارق المخلفات البلدية والطبية وحرق المخلفات في العراء، وقد إتضح أن الدايوكسينات ثنائية البنزين متعددة الكلور والفيورانات ثنائية البنزين متعددة الكلور أكبر تهديد لصحة البشر وللنظم البيئية بصفة عامة، وبالرغم من أن البيانات حول مستويات الدايوكسينات ثنائية البنزين متعددة الكلور والفيورانات ثنائية البنزين متعددة الكلور نادرة إلا أن تقديرات الإطلاق في البيئة نتيجة للأنشطة الصناعية والبشرية توضح بأن هناك مدخلات كبيرة في النظام، ومن المحتمل أن تكون الدايوكسينات ثنائية البنزين متعددة الكلور والفيورانات ثنائية البنزين متعددة الكلور من خلال الإطلاق غير المتعمد

مقترنة بالسُمية العالية والخصائص التراكمية أهم المواد السامة الثابتة التي يجب تقييمها في المستقبل.

المشاكل التي تم تحديدها:

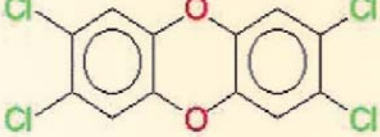
- عدم وجود إدارة سليمة للمخلفات وبصفة خاصة تجاه الحد من الحرق غير المتحكم فيه.
- حرق غير سليم للمخلفات الطبية.
- تنفيذ غير ملائم لمتطلبات أفضل التقنيات المتاحة المنصوص عليها في المرسوم السلطاني رقم ٢٠٠١/١١٤.

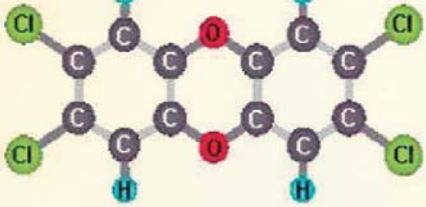
الإجـراء	الإطـار الزمنـي
• مراجعة لمواقع الطمر القائمة وتوفير التقنيات الجديدة لضمان إدارتها بطريقة سليمة بيئياً	٢٠٠٩-٢٠١٤
• التأكد من التنفيذ الجيد للوائح الخاصة بأفضل التقنيات المتاحة وأفضل الممارسات البيئية في الصناعة (وفقاً للمرسوم السلطاني رقم ٢٠٠١/١١٤)	٢٠٠٩-٢٠١٢
• ضمان التنفيذ الجيد للوائح فيما يتعلق بأفضل التقنيات المتاحة وأفضل الممارسات البيئية الخاصة بحرق المخلفات الطبية (وفقاً للمرسوم السلطاني رقم ٢٠٠١/١١٤)	٢٠٠٨-٢٠١٣
• ضمان التنفيذ الجيد للوائح فيما يتعلق بحرق المخلفات في الفناء الخلفي (وفقاً للمرسوم السلطاني رقم ٢٠٠١/١١٤ والقرار الوزاري رقم ٩٣/١٧)	٢٠٠٩-٢٠١٢
• تقديم التدريب للموظفين الفنيين والمحليين حول أفضل التقنيات المتاحة وأفضل الممارسات البيئية	يبدأ من ٢٠٠٩
• تقديم المعرفة الكافية بشأن المنتجات الثانوية للملوثات العضوية الثابتة على مستوى إدارة المصنع	تبدأ من ٢٠٠٩
• زيادة الوعي حول المخاطر الناجمة عن الحرق غير المتحكم فيه للمخلفات وإجراءات السلامة	يبدأ من ٢٠٠٩

المواقع الملوثة والإطلاق من المخزون الاحتياطي والمخلفات:

الوضع في عُمان:

ليس هناك مواقع ملوثة بمبيدات الملوثات العضوية الثابتة، وعلاوة على ذلك ليس هناك سجلات عن الاستخدام المكثف لمثل هذه المبيدات في البلاد، وذو صلة بمبيد د. د. ت يعتقد بأن احتمالات تلوث التربة والمياه وسلسلة الغذاء أو الأوساط البيئية الأخرى في أدنى حدودها باعتبار أن مبيد د. د. ت يستخدم داخل المباني فقط، وبالرغم من ذلك فإن هذا لا يقلل من مدى الحاجة لتقييم التأثيرات الناتجة للاستخدامات السابقة، وبناءً على ذلك فقد تم القيام بتقييم مبدئي لبقايا مبيد د. د. ت وكذلك تقييم لمخاطر الاستخدام السابق للمبيد في داخل المباني في عُمان.وقد تطلبت الدراسة تحليل لعينات من الهواء والغبار من داخل المنازل في المناطق التي تم فيها رش مبيد د. د. ت وذلك باستخدام منازل لم يتم فيها رش المبيد كعينة مقابلة لتلك، أما العينات الأخرى التي تم اختبارها فقد تضمنت الهواء المحيط من مناطق صناعية وسكنية وعينات من التربة لأغراض التأكد من إمكانية انتقال مبيد د. د. ت من الداخل إلي الخارج، وقد وجد بأن بقايا مبيد د. د. ت أعلى من معايير الاتحاد الأوروبي في الأماكن التي تم فيها تخزين أو استخدام المبيد في السابق. أما فيما يتعلق بمستويات مركبات ثنائي الفينيل متعدد الكلور وسداسي كلور البنزين أقل بكثير من المستويات الأوروبية في نفس المناطق، وقد لوحظ - من حيث المخاطر- وجود مخاطر مسببة للسرطان من خلال تعرض البشرة في أحد المواقع الذي كان يستخدم لتخزين مبيد د. د. ت، كما تم الكشف في مواقع أخرى عن وجود مخاطر كبيرة مسببة للسرطان من خلال الاستنشاق، وعليه فقد تم التوصية بإعادة تشييد وتنظيف الجدران والسقوف والأرضيات للمنازل في المناطق ذات الصلة، أما بالنسبة لمركبات ثنائي الفينيل متعدد الكلور فقد تم تحديد المناطق الأربع الرئيسة المحتمل أن تكون تلوثت وهي الورش التي يتم فيها صيانة المحولات والمستودعات لتخزينها والأماكن التي كانت فيها محولات مسربة والمناطق التي اشتعلت فيها النيران باعتبار أن احتراق المحولات من المصادر الأساسية لإطلاق الدايوكسينات والفيورانات والتي يمكن أن تلوث المعدات والتربة، وعلى كل تجدر الملاحظة أنه لم يتم حتى الآن إجراء اختبار للتأكد من تلوث الورش أو المستودعات كما لم يتم





القيام بإجراء تفتيش لتحديد التلوث الناجم عن تسرب المحولات، وعلاوة على ذلك لا توجد سجلات لأماكن المحولات المحترقة، وبالتالي تستدعي الحاجة إلي القيام بعمل حصر تفصيلي وذلك من أجل الحصول على صورة واضحة للوضع.

الـرصـد:

وضع الدولة:

تقع مسئولية الرصد الكلي للمواد الكيميائية المستوردة والمتداولة والمستخدمة في السلطنة على قسم الرصد والتقييم في دائرة المواد الكيميائية بوزارة البيئة والشئون المناخية، ويأتي الدعم بدرجة كبيرة من المختبر الرئيسي للوزارة والذي تقع على مسئوليته تحليل مختلف المنتجات الغذائية والأوساط البيئية والمواد الخام الصناعية وتحديد معايير ضبط الجودة، حيث يقوم قسم تحليل الملوثات العضوية بهذا المختبر بتحليل المبيدات ومبيدات الكلور العضوي والأغذية المحتملة التلوث خاصة الأسماك واللحوم، كما يحلل أيضاً كثافة الهيدروكربونات في الهواء والمياه والتربة من بين الملوثات الأخرى.

ويبدو أن هناك ندرة في بيانات الرصد لمركبات ثنائي الفينيل متعدد الكلور، واما فيما يتعلق بمبيدات مركبات ثنائي الفينيل متعدد الكلور فمن المحتمل أن رصد تأثيراتها الناتجة على البشر والبيئة أو سلسلة الأغذية ليس من الأولويات طالما أنه من المفترض عدم وجود مواقع ملوثة بمبيد مركبات ثنائي الفينيل متعدد الكلور في السلطنة، كما لا توجد بيانات متاحة عن رصد مبيد د. د. ت في البشر أو سلسلة الغذاء أو البيئة، على كل يجدر ملاحظة أنه قد تم القيام بتقييم مخاطر الاستخدام السابق لمبيد د. د. ت في داخل المباني.

وبالرغم من أنه من المفترض وجود محولات ملوثة بمركبات ثنائي الفينيل متعدد الكلور في السلطنة ، إلا أن الأمر يتطلب وضع رصد الأنشطة الخاصة بالإدارة الآمنة والسليمة للمواد ذات الصلة بمركبات ثنائي الفينيل متعدد الكلور في موضعها الصحيح، كما أن هناك نقص في اللوائح أو الإرشادات الخاصة بإدارة مثل مركبات ثنائي الفينيل متعدد الكلور وكذلك تقييد الدخول إلي المواقع المشتبه بأن تكون فيها محولات مركبة أو اشتعلت فيها النيران، وحتى الآن يبدو بأنه لا توجد معلومات جيدة عن تأثيرات مركبات ثنائي الفينيل متعدد الكلور على صحة الإنسان والبيئة.

الإبلاغ وتبادل المعلومات:

وضع الدولة:

تقتصر إجراءات الإبلاغ وتبادل المعلومات حول مركبات ثنائي الفينيل متعدد الكلور على الالتزامات الوطنية بالاتفاقيات الدولية الخاصة بالمواد الكيميائية ومركبات ثنائي الفينيل متعدد الكلور على وجه الخصوص وبشكل خاص اتفاقيات استكهولم وروتردام وبازل.

زيادة التوعية العامة عن الملوثات العضوية الثابتة

وضع الدولة:

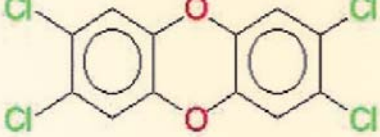
إن كافة التشريعات المتعلقة بالمواد الكيمائية تم نشرها في الجريدة الرسمية، كما تم نشرها أيضاً في الصحف وإذاعتها في أخبار وبرامج المذياع والتلفاز، كما قامت وزارة البيئة والشئون المناخية بطباعتها في شكل نشرات للتوزيع العام، كما تم تقديم التوعية العامة بمخاطر المبيدات والمواد الكيمائية الصناعية وإدارتها من خلال الندوات والمحاضرات التي تم تنظيمها للعديد من قطاعات المجتمع (المدارس والكليات والجامعات والجمعيات النسائية والقطاع الخاص وغيرها).

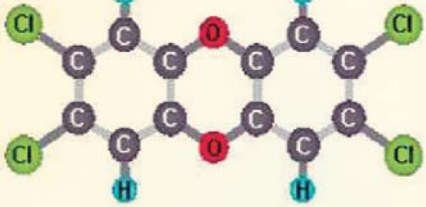
وفي حالة مركبات ثنائي الفينيل متعدد الكلور هناك نقص في المعلومات المتعلقة بالمخاطر الصحية المحتملة لمركبات ثنائي الفينيل متعدد الكلور وذلك لأن مناهج التعليم العام والنظام التعليم المهني الخاص في عُمان لم تتضمن مواد متعلقة بمواضيع الصحة المتأثرة بمركبات ثنائي الفينيل متعدد الكلور. كما ينعدم أيضاً الوعي بالمخاطر المحتملة للحرق المفتوح للمخلفات والإدارة غير السليمة لمواقع طمر المخلفات وإنتاج المنتجات الثانوية للملوثات العضوية الثابتة بطريقة غير متعمدة خاصة الدايوكسينات والفيورانات وكيفية التقليل أو الحد من إطلاقها، كما أن هناك عدم فهم لدى العامة بشكل عام وصناع القرارات وموظفي الحكومة وعمال المرافق الكهربائية بشأن مركبات ثنائي الفينيل متعدد الكلور وكيف يمكن أن تؤثر على صحة البشر والبيئة، وذلك لأن عُمان ليس لديها خبرة في مركبات ثنائي الفينيل متعدد الكلور والمخاطر ذات الصلة. وعلى كل، ومع بداية مشروع خطة التنفيذ الوطنية بدأ بعض الموظفين الحكوميين اكتساب المعرفة والوعي بمركبات ثنائي الفينيل متعدد الكلور، علاوة على ذلك فقد ازداد الوعي بمركبات ثنائي الفينيل متعدد الكلور من خلال بعض ورش العمل التدريبية بمساعدة من الخبراء الدوليين، وبالتالي تحسن الوعي بمركبات ثنائي الفينيل متعدد الكلور إلي حد ما، كما تم القيام بتدريب بعض مختصي وزارة البيئة والشئون المناخية ووزارة التجارة والصناعة ومرافق الكهرباء وذلك لكي يكتسبوا المزيد من الخبرة فيما يتعلق بمواضيع مركبات ثنائي الفينيل متعدد الكلور.

أما فيما يتعلق بمبيد د. د. ت فهناك إدراك عام بمشاكله، غير أن هناك نقص في البيانات العلمية حول مخاطره المحتملة إلي أن بدأ العمل بخطة التنفيذ الوطنية عندما تم القيام بدراسة تقييم للمخاطر. وفيما يخص بالمنتجات الثانوية للملوثات العضوية الثابتة نجد أن الحاجة تستدعي إجراء رصد لالزام الصناعة بتطبيق أفضل الممارسات البيئية وأفضل التقنيات المتاحة وكذلك المعرفة العامة بمخاطر الحرق في العراء سواء كان ذلك في المزارع أو الفناء الخلفي أو في عملية الاستخلاص أو في مرادم البلديات علاوة على ذلك هناك حاجة لزيادة الوعي بين السكان المقيمين حول مواقع محارق المخلفات الطبية وطمر المخلفات، حيث أن مثل هؤلاء السكان غالباً ما يكونون بصفة عامة قلقين من انبعاث الدخان الأسود والرائحة الكريهة، غير أنهم في حاجة لمعرفة المخاطر الحقيقية الناجمة عن مثل هذا الدخان وأن يرفعوا ملاحظاتهم للجهات الحكومية الملائمة.

المشاكل التي تم تحديدها:

- لم يصبح التدريب الفني للتعرف على مركبات ثنائي الفينيل متعدد الكلور ومخاطرها بعد متاحاً على نحو واسع.
- ما تزال البرامج التثقيفية للموظفين والعمال المتعرضين للخطر غير ملائمة، كما لم يزل التدريب الشامل على مركبات ثنائي الفينيل متعدد الكلور من خلال وسائل الإعلام غير متاح.
- ما يزال دعم برامج تقوية التوعية العامة بخصوص مركبات ثنائي الفينيل متعدد الكلور غير متوفر، كما أن الآليات الوطنية والدولية لتبادل المعلومات ونقل التقنية محدودة.
- غياب سجلات البيانات وقواعد بيانات نظم الإدارة الخاصة بمواضيع مركبات ثنائي الفينيل متعدد الكلور.
- ندرة المعلومات حول الاستخدامات السابقة لمبيدات الملوثات العضوية الثابتة.
- عدم وجود وعي بين المجتمع حول الاستخدامات السابقة لمبيدات الملوثات العضوية الثابتة وتأثيراتها المحتملة.
- عدم وجود بيانات حول البقايا المحتملة في الأغذية المستوردة والمنتجة محلياً.
- عدم وجود وعي بين عمال الصحة حول التأثيرات المحتملة والناتجة عن التعرض لمبيد د. د. ت.
- إدارة غير ملائمة للمخلفات وعلى وجه الخصوص حرق المخلفات الصلبة غير المتحكم فيه.
- تنفيذ غير ملائم لمتطلبات أفضل التقنيات المتاحة.





الإجـراء	الإطـار الزمنـي
• إعداد خطة خاصة بنشر المعلومات ذات الصلة بمركبات ثنائي الفينيل متعدد الكلور	٢٠٠٩-٢٠١١
• إعداد عمليات وإجراءات لإيجاد حلول مشتركة لمشاكل مركبات ثنائي الفينيل متعدد الكلور	٢٠٠٩-٢٠١٣
• إعداد ونشر المعلومات المتعلقة بمركبات ثنائي الفينيل متعدد الكلور في وسائل الإعلام	٢٠٠٨-٢٠١٢
• زيادة الوعي حول المخاطر الصحية المحتملة والتأثيرات المتخلفة من الاستخدامات السابقة لمبيدات الملوثات العضوية الثابتة	٢٠٠٨-٢٠٢٥
• زيادة الوعي بالإدارة السليمة للمبيدات	٢٠٠٨-٢٠٢٥
• زيادة الوعي بالتأثيرات المتخلفة نتيجة للاستخدامات السابقة لمبيد د. د. ت	٢٠٠٩-٢٠١٢
• ضمان التنفيذ الجيد للوائح الخاصة بأفضل التقنيات المتاحة وأفضل الممارسات البيئية	٢٠٠٨-٢٠٢٥
• زيادة التوعية العامة حول المخاطر والمخاطر الصحية الناجمة عن الحرق غير المتحكم فيه للمخلفات في العراء	٢٠٠٨-٢٠٢٥

الإطار التنظيمي والقانوني:

وضع الدولة:

قامت سلطنة عُمان، تأكيداً لالتزامها بحماية مواطنيها والبيئة من مخاطر هذه المواد، بإصدار نظام تداول واستخدام الكيميائيات بموجب المرسوم السلطاني رقم (٩٥/٤٦)، ولأغراض تنفيذ هذا النظام قامت وزارة البيئة والشئون المناخية بإصدار لائحة تسجيل المواد الكيميائية والتصاريح الخاصة بها بموجب القرار الوزاري رقم (٩٧/٢٤٨) بتاريخ ٦ يوليو ١٩٩٧.

وتقع على قسم البيانات والتراخيص بدائرة المواد الكيميائية مسئولية إصدار التصاريح الخاصة بتداول المواد الكيميائية الخطرة بما في ذلك المبيدات وذلك بالتنسيق مع وزارة الزراعة التي تتحكم في استيراد وتصدير المبيدات وتقوم بإعداد قائمة المبيدات المحظورة والمقيدة.

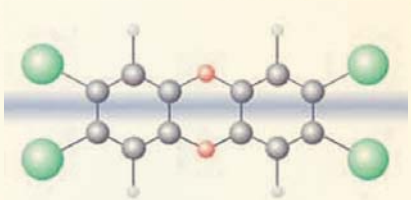
لقد تم تشكيل لجنة دائمة للمواد الكيميائية وفقاً للمادة (٣) من النظام المذكور أعلاه، وتتراوح اختصاصات هذه اللجنة من إعداد ومتابعة تنفيذ اللوائح اللازمة إلي رصد والتعامل مع المخالفات والتعاون مع المنظمات الإقليمية والدولية لتعزيز الجهود وذلك للتأكد من أن استخدام المواد الكيميائية لا يعرض الصحة والبيئة للخطر.
كما تم أيضاً تشكيل لجنة فنية وفقاً للقرار الوزاري رقم (٢٠٠/١١٥) برئاسة مدير دائرة المواد الكيميائية في وزارة البيئة والشئون المناخية وهي الجهة المركزية بالنسبة لإعداد القرارات للجنة الدائمة للمواد الكيميائية.

البحوث والتنمية:

الوضع الحالي:

يوجد في السلطنة العديد من المختبرات التي تتبع لجهات حكومية والتي تعمل من أجل أغراض ومهام محددة، وفيما يلي معلومات حول هذه المختبرات:

- يقوم مختبر وزارة الزراعة بتحليل الأسمدة والمبيدات.
- يهدف مختبر وزارة التجارة والصناعة إلي التحكم والتأكد من حدود الكيميائيات في كافة أنواع السلع التي يتم المتاجرة بها وتسويقها في جميع أرجاء السلطنة ولأغراض الاستيراد والتصدير، كما يقوم أيضاً بتحليل المواد الكيميائية الصناعية المستخدمة لإنتاج السلع والمواد والتأكد من الحدود المقبولة في المنتجات الصناعية.



- يعمل مختبر وزارة البلديات الإقليمية وموارد المياه في تحليل الملوثات في مختلف الأوساط والأغذية المستوردة والمنتجة في عُمان.
- مختبر وزارة الصحة لديه القدرة على تحليل المواد الكيميائية في الأدوية والمستحضرات الصيدلانية.

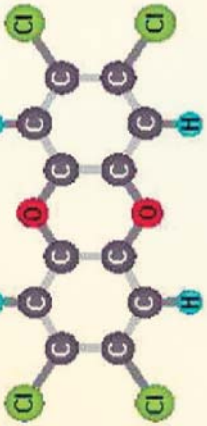
ومع ذلك ليس هناك تنسيق كاف بين هذه المختبرات، حيث أن كل مختبر يعمل لتحقيق أهدافه المحددة أثناء تحليله للمواد الكيميائية. علاوة على ذلك، يحتفظ بنتائج التحاليل للاستخدام الداخلي فقط ونادراً ما تتم مبادلتها مع الآخرين حتى عندما تقدم طلبات بذلك، ويعزي ذلك بدرجة رئيسة لضعف الترابط بين الوزارات الحكومية بالنسبة لتبادل المعلومات الخاصة بنتائج تحليل المواد الكيميائية، أضف إلى ذلك أن كل مختبر يواجه مسئولية تمويل تحاليله وبالتالي لا يرى أنه ملزم بتبادل نتائجها مع الآخرين.

الإطار ومتطلبات الموارد:

تكمن تقديرات التأثيرات الاجتماعية والاقتصادية لخطة التنفيذ الوطنية في السلطنة في أنشطة التشغيل الرئيسة التالية والتي كل منها توضح بالتفصيل الجوانب الرئيسية مثل التأثيرات البيئية والصحية والاجتماعية والاقتصادية بحسب ما موضح في الجدول أدناه:

الجدول (١)

النشاط	البيئي	الصحي	الاجتماعي	الاقتصادي	المدة	التكلفة
تقليل وإزالة المنتجات الثانوية للمواد العضوية الثابتة	تحليل كيميائي وتنفيذ أفضل الممارسات البيئية/أفضل التقنيات المتاحة وإعداد آليات للرصد	تقديم الرعاية الصحية للعمل المعرضين للخطر والسكان المحليين	زيادة الوعي ودفع التعويضات	التخلص تدريجياً من مواقع الحرق في العراء واستبدالها بمحارق حديثة وتركيب محارق مخلفات طبية جديدة خاصة	٢٠٠٨-٢٠١٤	٦٥,٤٦٠,٠٠٠
معالجة التلوث بمركبات ثنائي الفينيل متعدد الكلور	تحديد واختبار المواقع المحتمل أن تكون ملوثة، وإعداد نظام للرصد والتخلص السليم من مركبات ثنائي الفينيل متعدد الكلور والتنظيف وإعادة التأهيل	إخضاع العمال والمقيمين المعرضين للخطر للاختبار ومعالجتهم	التوعية والتعويض	التخلص التدريجي من المعدات المستخدمة لمركبات ثنائي الفينيل متعدد الأغراض الملوثة واستبدالها بمحولات خالية من مركبات ثنائي الفينيل متعدد الكلور وتقوية التشريعات وإعداد إجراءات سليمة خاصة بصيانة المعدات المستخدمة لمركبات ثنائي الفينيل متعدد الكلور	٢٠٠٨-٢٠٢٥	٥,٦١٢,٠٠٠
مبيدات الملوثات العضوية الثابتة	التحديد وتنظيف وإعادة تأهيل المواقع الملوثة	إخضاع المزارعين/ المقيمين المتأثرين للاختبار ومعالجتهم	لا شيء	لا شيء	٢٠٠٨-٢٠٢٥	٨٠,٠٠٠
مبيد د. د. ت	كما ورد أعلاه	تقديم الرعاية الصحية	إعادة تشييد وتنظيف الأسقف والجدران	لا شيء	٢٠٠٨-٢٠٢٥	١,٠٠٠٠٠



الخـــلاصة :

إن خطة التنفيذ الوطنية للسلطنة عبارة عن نتاج جهود مضاعفة ومشاريع تضمنت فرق عمل من الخبراء وممثلين لأصحاب المصلحة من ذوي الصلة بمواضيع الملوثات العضوية الثابتة وقد اشتملت الجهود الرئيسة على تقييم للواقع الحالي في السلطنة بتوجيه من الأحكام ذات الصلة في الاتفاقية وبمساعدة من الاستشاريين وقوائم الحصر ومراجعة المستندات وقواعد البيانات وتحديد المشاكل ذات الأولوية واقتراح الاستراتيجيات وخطط العمل بحسب الحالة وذلك لتحقيق الأهداف المحددة والمطلوبة من الأطراف في الاتفاقية، وتتضمن المخرجات الرئيسة المنظور الوطني الخاص بتقييم قدرات السلطنة للتعامل مع المواد الكيميائية والتقييم الدقيق للمواضيع ذات العلاقة بالملوثات العضوية الثابتة في عُمان ومراجعة التشريعات والقدرات التنظيمية الخاصة بتنفيذ مثل هذه التشريعات وإدارة الملوثات العضوية وفقاً للاتفاقيات الدولية وقائمة حصر لاستخدام مبيدات الملوثات العضوية الثابتة في السلطنة وتقييم المعدات المحتمل احتوائها لمركبات ثنائي الفينيل متعدد الكلور وقائمة حصر للمنتجات الثانوية للملوثات العضوية الثابتة وتقييم لمخاطر مبيد د. د. ت وتحديد المشاكل الرئيسة وتحديد خطط العمل الفورية والاستراتيجيات طويلة المدى بالإضافة إلى الإطار الزمني وتكاليف متطلبات تحقيق مثل هذه الأهداف، والمقترحات الخاصة بالرصد وإدارة البيانات والإبلاغ وتبادل المعلومات وتسهيلات البحوث والتنمية وزيادة الوعي بين مختلف المستهدفين فيما يتعلق بمختلف جوانب الملوثات العضوية الثابتة في السلطنة.

تقديم

تسعى السلطنة بخطى حثيثة نحو تحقيق أهدافها في تعزيز وضعها كدولة مستقرة ومتقدمة وقادرة على إتاحة الفرص لمواطنيها لمجابهة تحديات العصر المختلفة، وأدركت منذ البداية مسترشدة بتوجيهات حضرة صاحب الجلالة السلطان قابوس بن سعيد المعظم حفظه الله ورعاه، ومستفيدة من تجارب دول العالم في ضرورة الربط الوثيق بين مسيرة التنمية وحماية البيئة وصون الموارد الطبيعية تكاملاً وتحقيقا للتنمية المستدامة ، وعليه فان النظام الأساسي للدولة مروراً بالاستراتيجية الوطنية لحماية البيئة العمانية و الإستراتيجية الوطنية وخطة عمل التنوع الاحيائي وخطط التنمية الخمسية وصولاً إلى الرؤية المستقبلية (عمان ٢٠٢٠) ، وتعزيزا للتواصل بالمنظمات الإقليمية والعالمية المنظمة إليها السلطنة ، قد أوجد نصوص واضحة تلزم بتضمين الاعتبارات البيئية في جميع خطط تنفيذ المشاريع المتعلقة بمجالات التنمية المستدامة.

وعلاوة على ذلك ، فان هناك تشريعات وطنية تتطرق بعينها للعديد من المواضيع المتعلقة بحماية البيئة و الشؤون المناخية التي تهدف جميعها إلى المحافظة على البيئة وصون الموارد الطبيعية ، كقانون حماية البيئة ومكافحة التلوث الصادر بموجب المرسوم السلطاني رقم (١٩٨٢/١٠) والمعدل بالمرسوم السلطاني رقم (٢٠٠١/١١٤) وقانون حماية مصادر مياه الشرب من التلوث الصادر بموجب المرسوم السلطاني رقم (٢٠٠١/١١٥) وقانون المحميات الطبيعية وصون الأحياء الفطرية الصادر بموجب المرسوم السلطاني رقم (٢٠٠٣/٦).

ونظرا للطفرة الصناعية التي اتجهت إليها معظم المجتمعات المتحضرة في جميع أنحاء العالم وبشكل متزايد نحو استخدام المواد الكيميائية ، وبالرغم من أن معظم المواد مفيدة وتستخدم في إنتاج السلع الأساسية التي تتراوح ما بين الأغذية إلى الأدوية ، والبعض منها يستخدم لتحسين الإنتاجية الزراعية أو توليد الطاقة أو تصنيع المنتجات الكيميائية التي نستخدمها يومياً ، إلا أننا نجد أنها بذاتها أو بما لديها من إمكانيات كيميائية قادرة على إطلاق منتجات فرعية خطرة تشكل أضرارا خطيرة على البيئة وصحة الإنسان.

وإدراكا لهذه الحقيقة فقد سعت حكومة السلطنة على أن تتجاوز مرحلة التشريعات العامة الخاصة بحماية البيئة ومكافحة التلوث لتسن قانون يقوم بالتعامل بصفة خاصة مع تداول المواد الكيميائية، وذلك بصدور المرسوم السلطاني رقم (٩٥/٤٦) الخاص بنظام تداول واستخدام الكيميائيات، حيث أن هذا القانون منح الوزارة السلطة لإنشاء دائرة للمواد الكيميائية تقوم بإدارة المواد الكيميائية بطرق سليمة في السلطنة من حيث استيرادها وتصديرها واستخدامها وتخزينها والتخلص منها. و وفقاً لمتطلبات هذا القانون ، فقد قامت الوزارة بإصدار لائحة تسجيل المواد الكيميائية والتصاريح الخاصة بها بالقرار الوزاري رقم (٩٧/٢٤٨) ، وكذلك لائحة شروط التعبئة والتغليف و وضع البيانات والملصقات للمواد الكيميائية الخطرة وفقا للقرار الوزاري رقم (٣١٧ / ٢٠٠١).

وتوافقاً مع هذا النهج فقد اعتمدت السلطنة مبدأ الالتزام التام بالمسار والمبادئ الأساسية التي أقرها المجتمع الدولي ونصت عليها الاتفاقيات البيئية الإقليمية والدولية في تحقيق أهداف التنمية المستدامة، و ترسيخا لاهتمام السلطنة بمدى الحاجة إلى التعاون الإقليمي والدولي لإدارة المواد الكيميائية الخطرة ، فقد صادقت السلطنة على اتفاقية استوكهولم للملوثات العضوية الثابتة (POPs) بموجب المرسوم السلطاني السامي رقم (٢٠٠٤/١١٧) و التي تعتبر آلية مناسبة لحماية البيئة وصحة الإنسان من خلال تنظيم تداول واستخدام الملوثات العضوية الثابتة.

ولتنفيذ التزامات هذه الاتفاقية فقد تم تنفيذ مشروع الأنشطة التمكينية لوضع وثيقة خطة التطبيق الوطني لتلك الاتفاقية والتي وصلت إلى مرحلة التنفيذ للخطط الوطنية المحددة والمتعلقة بالإدارة السليمة للمواد الكيميائية ، حيث أن السلطنة ملتزمة بتحقيق مختلف الاستراتيجيات وخطط العمل المدرجة بالتفصيل في هذه الوثيقة، والتي تعكس موقف السلطنة الدائم في الاهتمام بقضايا البيئة العالمية وتحقيقاً لمبادئ التنمية المستدامة.

Preface

The Sultanate of Oman is making remarkable strides in its goal of consolidating its status as a peaceful, stable and progressive nation capable of availing its people of ample opportunities to grapple with the challenges of the 21st Century. As the development train gathered pace, blooming into notable projects in the various sectors, it was obvious right from the beginning that the entire process had to be well regulated and monitored if only to ensure that the welfare of the environment, so treasured by the Government and people of Oman, was not compromised. Thus, from the Basic Law of the State through the 1996 National Conservation Strategy and the five-year development plans to the more recent Oman 2020 Vision, there have been clear provisions making it mandatory for environmental considerations to be incorporated into all aspects of development plans and projects in Oman whether in the provision of public infrastructure, expansion of industrial enterprise, privatization of the economy, development of agriculture or promotion of tourism.

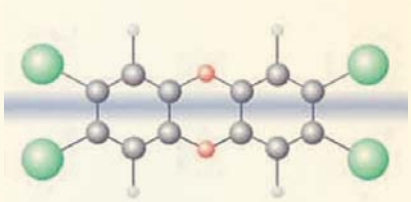
Furthermore, there are specific national legislation addressing various environmental issues, all aimed at preserving the environment and conservation of natural resources. These include Laws on the Conservation of the Environment and Prevention of Pollution (RD114/2001), Protection of Water Resources from Pollution (RD 115/2001) and Protection of Nature Reserves and Conservation of Wild Life (RD 6/2003).

Given the pace of modernization, especially the reliance on industrialization for the mass production of goods and services, and the expansion of public utilities for the satisfaction of ever-expanding populations, societies all over the world are increasingly becoming chemically oriented. While most chemicals are beneficially used in production of essential goods ranging from food to medication, others used in improving agricultural productivity, generating power, or producing chemical products that we use daily, may by themselves or by their potential to release hazardous by-products, constitute serious hazards to the environment and human beings.

In Oman it was the realization of this fact that inspired Government to go further than the general legislation on environmental conservation and prevention of pollution, to enact a Law specifically guiding the Handling and Use of Chemicals (RD 46/95). The Law empowers MECA to set up a Chemical Substances Department charged with the overall coordination of issues related to the import, export, use, distribution, storing and disposal of chemicals in the Sultanate, and in compliance with the requirements of the Law, MECA produced MD248/97 on registration of chemical substances and issuing of the necessary permits by the Chemicals Department

Realizing the need for regional and international collaboration towards the management of hazardous chemicals, Oman has since ratified the relevant international Conventions in addition to pursuing its commitments to Agenda 21, and is now at the stage of implementing its national plans with regard to the management of chemicals in accordance with its obligation to the Stockholm Convention. This Convention, aimed at protecting human health and the environment against Persistent Organic Pollutants, was ratified by the Sultanate on 24 November 2004.

Beyond the production of the National Implementation Plan (NIP), we are committed to the actualization of the various strategies and action plans detailed herein, and it is our hope that in return, we will be availed of continuing international support to assist us in achieving our targets.





Executive Summary

Introduction

Apart from their toxicity, volatility, low degradability and bioaccumulation, Persistent Organic Pollutants (POPs) are known for their ability to transcend national boundaries. This was the main compelling factor behind the decision to take joint action at the international level to find common solutions to problems associated with the production, importation, exportation, transportation, distribution, use, storage and disposal of the 12 substances listed under this group of chemicals. In the face of incontrovertible evidence on the adverse impacts of POPs on human health and the environment, the POPs Protocol to the Convention on Long-Range Trans boundary Air Pollution (1998) and the Stockholm Convention on POPs (2001) were adopted. In union with other signatories and parties, the Sultanate of Oman became a Party to the Stockholm Convention in 2005, and pursuant to the requirement to develop a plan to meet the obligations of the Convention, set up the necessary machinery to produce the National Implementation Plan (NIP) with generous support for finance and capacity building through UNEP and GEF toward enabling activities to strengthen the NIP production process.

Objective

The main target of the NIP was to assess the prevalence of POPs in the Sultanate and issues related to them, identify problems associated with POPs, and to present a clear course of actions and strategies to deal with them, in accordance with national objectives and priorities and in line with Oman's obligation to the Stockholm Convention.

Method of Approach

In line with the environmental protection philosophy of the Sultanate, the management of chemicals in general falls within the ambit of the Ministry of Environment and Climate Affairs (MECA). However, in recognition of the involvement of other government and non-government establishments in the handling of chemicals, it became necessary to approach the task of producing the NIP from an inter-ministerial, multi-sectoral approach. Thus, with MECA as principal coordinating agency, a committee comprising experts in relevant departments dealing with chemicals in stakeholder establishments was convened as a first step Annex - Key Members of the National Expert's Task Team. From these, task force teams were formed and a series of workshops was held to provide training, clarification and guidelines on the gradual procedure for the eventual production of the NIP.

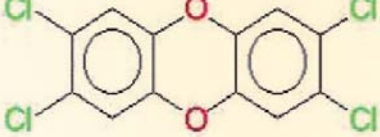
NIP Framework

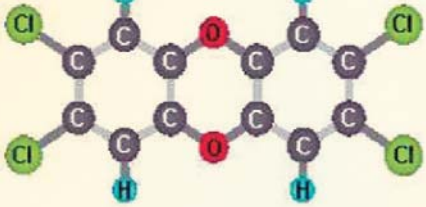
Based on relevant literature and analysis of data from various sources, especially inventories and databases, the National Implementation Plan for the Sultanate of Oman is a comprehensive report on the various aspects dealing with POPs management as specified in the Stockholm Convention. It starts with a sweeping overview of the Oman national profile (NP) with particular reference to POPs issues and problems, and describes the current regulatory and institutional framework guiding the management of POPs in the Sultanate. With reference to specific international obligations for parties to the Stockholm Convention, the NIP evaluates issues related to POPs in Oman, and outlines strategies and action plans for dealing with them, including deadlines for set targets and estimation of resources required. A cursory glance at the report shows the following major highlights:

POPs Pesticides

Country Situation

Placed under the authority of MECA and MOA, POPs pesticides prohibited under the Stockholm Convention are banned in Oman. A nation-wide inventory on POPs pesticide carried out by TTPE during the elaboration process of Oman NIP as well as an earlier inspection of pesticide markets from 2001 – 2003 showed that there are neither obsolete stocks of POPs pesticides nor contaminated sites in Oman. Furthermore, there is no evidence that the prohibited POPs pesticides were used in the past. This could be because agriculture in Oman before the 1980's was practised on a subsistence level using mostly traditional farming methods and implements, as agricultural lands at that time were equally limited. Awareness of POPs pesticides has been raised through different media. However, there are some concerns and recommendations related to the current use of POPs pesticides in general.





Identified Problems

- A lack of studies on environmental and health impact assessment of past use of pesticides
- Misleading labelling
- Unavailability of data on chemical residues in food.
- There is no detailed information on the past uses and disposal of POPs pesticides
- Pesticide smuggling.
- Lack of community awareness of POPs use in the past and possible impacts

Action Plan	***Time Frame***
• Improvement of pesticide regulatory system…… ….	2008-2010
• Ensuring that imported and locally produced food is free of POPs residue……	2011-2013
• Ensuring that imported pesticides comply with international and national legislation …	2008-2013
• Determining sites, quantities used, and residual concentration of previously used DDT and POPs pesticides…… ……..……...	2010-2011
• Assessment of risks due to past use of POPs pesticides, especially DDT……...	2006-2013
• Determining appropriate sites and mechanisms for disposal of POPs pesticides……	2008-2011
• Raising awareness on potential health risks and residual effects of pesticide use among health careworkers……...	2008-2013
• Raising public awareness on potential impacts and proper management of pesticides.....	2007-2025

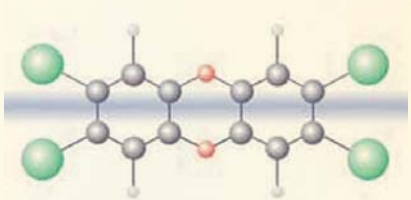
Polychlorinated-biphenyls (PCBs)

Country Situation

Under Royal Decree No. 46/95, which is the umbrella law on the handling and use of chemicals in the Sultanate, and Ministerial Decision 316/2001 which aims at specific chemicals, PCBs are prohibited in the Sultanate of Oman. However, as this regulation deals only with the direct use of PCBs, without addressing PCBs which are contained in sealed equipment in use, especially capacitors and transformers, a national PCB inventory had to be carried out on a sample of transformers covering variables such as year of manufacture (before and after 1990), transformer type (generation, transmission and distribution), and type of holder (Ministry, company). Of 143 transformers inventoried, only 36 or 26% were assumed to be PCB contaminated (based on standard PCB assumption rules), the majority of which happen to be those manufactured before 1990. There is little quantity of pure PCB oil transformers in Oman, as the average age of the transformers sampled is 13 years and they had been mostly imported before the ban of PCB in 1990. Contamination is believed to have been caused by maintenance operation. The inventory also showed 254 transformers labelled with a density ratio higher than 0.35, which can ordinarily be assumed to have been designed and manufactured as PCB transformers. It will however require an accurate test to determine if these are actually filled with PCB oil or whether they have been retro-filled with mineral oil.

Identified Problems

- No system in place for phasing out the existing PCBs containing equipment
- Incomplete transformer database (need to confirm and estimate PCBs content in the PCBs assumed transformers)
- Non existent laboratory capacity for PCBs analysis to confirm assumed PCBs contamination and estimate exact PCBs content
- No PCBs transformers monitoring system in place
- No management system for leaking transformers in place
- Lack of knowledge regarding PCBs problems
- No system for environmentally sound disposal of hazardous waste including PCBs
- No precaution measures taken to avoid contamination by PCBs containing transformers
- Limited human resources in the field of awareness raising on PCBs related issues
- Weak coordination between different authorities and the public sector
- Limited public involvement in decision making





Action Plan ***Time Frame***

- Strengthen and implement legislation for PCBs management…….. …… 2008-2012
- Establish procedures for PCB equipment maintenance…….. 2008-2009
- Establish qualified laboratory for PCBs analysis…… 2008-2010
- Prepare comprehensive guideline for use, labelling, storage, transportation, phase out, disposal of PCBs containing equipment…….……....2008-2025
- Establish stakeholder teams for inspection and management of PCB equipment……..…….2009-2025
- Gradual phasing out of PCB equipment…….……. 2011-2025
- Decontamination and rehabilitation of contaminated sites…….…….2011-2013

Dichloro-Diphenyl-Trichloroethane (DDT)

Country Baseline

For purposes of malaria control, a total quantity of 137,034 kg of DDT was sprayed indoors in some selected villages in 28 willayats from the various regions of Oman between 1976 and 1992. However DDT was never used for pest control or in outdoor application for mosquito eradication.

In fulfillment of Oman's commitment to international Conventions (Stockholm, Basel, Rotterdam) to which it is party, and which address chemicals, DDT was classified among chemicals regulated by Royal Decree No. 46/95. Additionally, MECA produced some Ministerial Decisions (MD) to guard against the hazards of chemicals. While MD 317/2001 regulates packaging and labelling of hazardous chemicals, MD 248/97 deals with registration of such chemicals, and MD 316/2001 specifically prohibits the use of DDT in Oman. Furthermore, the Civil Defence department of Royal Oman Police (ROP) issued guidelines on safe storage and transportation of hazardous chemicals, including DDT. Since 1992 DDT has been banned in Oman, and except for the period 1994-1998 when it was occasionally applied in isolated cases for the control of sand flies, the use of DDT has been completely stopped and replaced with organophosphates and synthetic pyrethroids. Today there is no available stock and none has been imported into the country since 1998**.**

Identified Problems

- Lack of studies on impact of past use of DDT on the environment and health
- Lack of awareness of possible residual impact due to exposure to DDT among health workers
- Lack of data on possible residues in imported and locally produced food
- Lack of public awareness on possible health impacts of past use of DDT

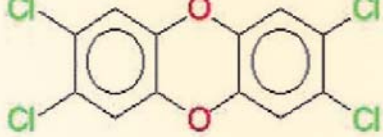
Action Plan ***Time Frame***

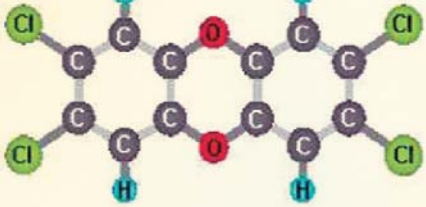
- Conducting environmental and health risk assessment of past use of DDT…….. 2008-2010
- Ensuring that imported and local foodstuff are free of POPs residue…..……...2011-2013
- Raising awareness among health workers on possible impacts and residual effects of DDT…….……. 2008-2025

Unintentionally produced POPs By-products

Country Situation

Open burning of waste and medical waste incinerators are considered major potential exposure sources, which may have negative impact on the population living in the surrounding areas. Other potential sources of unintentionally produced POPs by-products releases include oil refineries, metal industries, crematoria and diesel power generation, but these are not considered to have direct impact on human health in Oman. In the Gulf Region countries releases of dioxins and furans have been identified from aluminium and chlor-alkali plants, PVC plants, oil refineries, steel industry; municipal and medical waste incineration as well as open burning of waste. PCDD/PCDF was found to be of major threat to human health and the ecosystems in general. Even though data on PCDD/PCDF levels are scarce, estimates of releases to the environment due to industrial and human activities indicate a significant input to the system. Through unintentional release coupled with high toxicity and accumulative properties, PCDD and PCDF are possibly the most important persistent toxic substances (PTS) to be evaluated in the future.





Problems Identified

- Lack of proper waste management, in particular towards prevention of uncontrolled burning
- Improper medical waste incineration
- Insufficient enforcement of BAT requirements as stipulated in RD 114/2001

Action Plan ***Time Frame***

- Review of existing landfill sites and providing new technology to ensure their environmentally sound management……2008-2020
- Ensuring better enforcement of regulations regarding BAT/BEP in industry (according to RD 114/2001)…….. 2008-2010
- Ensuring better enforcement of regulation regarding BAT/BEP for medical waste incineration (according to RD 114/2001, MD 18/93)…….2008-2015
- Ensuring better enforcement of regulations regarding backyard burning of waste (according to RD 114/2001, MD17/93)…….2008-2010
- Providing training for technical staff and local officials on BAT & BEP…… 2008-2010
- Providing sufficient knowledge concerning POPs by-products at the plant management level…….2009-2011
- Raising public awareness about hazards of uncontrolled burning of wastes, and safety measures…….. 2008-2025

Contaminated Sites and Releases from Stockpiles and Wastes

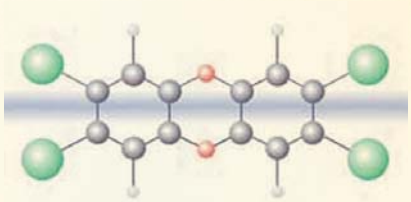
Situation in Oman

There are no sites contaminated with POPs pesticide, more so as there are no records of extensive use of such pesticides in the past in the country. Relative to DDT, the possibility of contamination of soil, water, food chain or other environmental media is believed to be very minimal considering that DDT was used indoors only. As part of preliminary steps towards producing the NIP, an evaluation study of DDT residues and risk assessment of past indoor use of DDT was done in affected areas of the Sultanate. Indoor air samples were taken from 12 households in areas where DDT had been sprayed and from one non-DDT house as a control. Furthermore, ambient air samples were taken from four locations in industrial and residential areas of Muscat. The sampling also covered indoor dust samples and soil samples taken to gauge possible DDT transport from indoor to outdoor environment. The results showed that in some sites DDT residue was higher than EU standards, and these were places where DDT was stored and used in the past. However, levels of two other OCPs (HCHs & HCBs) were lower than European levels. Using US Environmental Protection Agency (EPA) risk assessment approach to quantification of carcinogenic and non carcinogenic risks, there were no non-carcinogenic risks in all sites studied, but increased carcinogenic risks from dermal exposure were observed in one site which was used as storage for DDT. Significant potential carcinogenic risk for inhalation exposure was also detected in three locations in Rustaq, and it was recommended that reconstruction of houses in the three locations be done, with particular emphasis on cleaning up ceilings, walls and floors. With regard to PCBs, the four main areas with possibilities of being contaminated are identified as workshops where transformers are maintained, warehouses where transformers have been stored, places where there are leaking transformers and areas where transformers caught fire, considering that the burning of transformers is a high source of release of dioxin and furan which can contaminate equipment and soil. It should be noted however that so far no test has been done to establish contaminated workshops or warehouses while no site inspection has been carried to determine contamination from transformer leakage. Moreover there are no records about the location of burnt transformers. However, there is need to undertake additional detailed inventory for more accurate results.

Monitoring

Country Baseline

The overall monitoring of chemicals imported, handled and used in Oman falls to the Monitoring and Assessment section of the Chemical Substances Department of MECA. Back-up support comes largely from the Ministry's main laboratory known as the Food and Environment Control Centre, which has responsibility for analyzing different food products, environment media and industrial raw materials, and determining quality control standards. The Organic Pollutants Analysis unit of the Environmental and Food Chemistry section of





this laboratory handles the analysis of pesticides, organic chlorine pesticides and potentially polluted food, especially fish and meat. It also analyses the intensity of hydrocarbons in air, water and soil among other pollutants.

There appears to be a general dearth of monitored data on POPs. Relative to POPs pesticides, it is possible that monitoring their residual effects on humans, the environment or the food chain is not a priority since it is assumed that there are no POPs pesticide contaminated sites in Oman. There is also no available data on DDT monitoring in human beings, the food chain or the environment. However, as has been noted earlier, a risk assessment of past indoor application of DDT has been done.

Though it is assumed that transformers with PCB contaminated dielectric fluid exist in Oman, monitoring activities for safe and sound management of PCBs related materials and equipment have yet to be put in place. There is also a lack of regulations or guidelines on the management of such PCBs as well as restriction of access to locations where suspected PCB transformers are installed or caught fire. So far, there does not appear to be a good knowledge of the impacts of PCBs on human health and the environment.

Reporting and Information Exchange

Country Baseline

Procedures for reporting and information exchange on POPs are strictly based on national commitments to International Conventions on chemicals and POPs in particular especially the Stockholm, Rotterdam and Basle Conventions.

Raising Public Awareness on POPs.

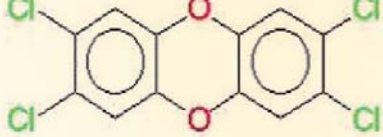
Country Situation

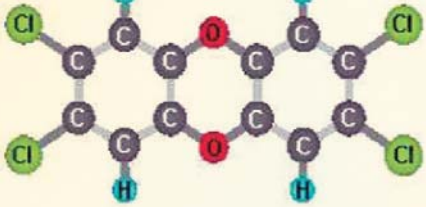
All legislation related to chemicals are published in the official gazette. They are also published in the press and broadcast in radio and TV news and programmes. MECA further publishes them in the form of pamphlets for public consumption. Public awareness on hazards of pesticides and their management is provided by means of seminars, and lectures held for various sectors of the community (schools, colleges, universities, women's associations , private sectors etc.).

Conversely, in the case of PCBs there is a lack of knowledge about the possible health hazards of PCBs as neither the general educational curricula nor specialized professional educational system in Oman have integrated subjects related to health issues affected by PCBs. Also lacking is awareness of the potential hazards of open incineration of waste, improper management of dump sites, generation of unintentionally produced POPs by-products, especially dioxins and furans, and how to reduce or prevent their release.

There is also a lack of understanding among the public in general as well as decision makers, government officials, and electrical utility workers about PCBs and how they can impact on human health and the environment. This is because Oman has no expertise on PCBs and related hazards. However, some governmental officials have just begun to learn about and gain awareness on PCBs with the commencement of the NIP project. In addition, through some training workshops with the assistance of international experts, PCBs awareness raising has improved to some extent. Some officials of the MECA, Ministry of Commerce and Industry as well as staff of some provincial and municipality electricity utilities have been trained to gain further expertise on PCBs issues.

With regard to DDT, There was a general perception of their problems, but there was a lack of scientific data on their potential hazards until the commencement of the NIP when a risk assessment study was undertaken. Relative to POPs by-products, there is a need to monitor industrial compliance with the application of BEP and BAT as well as public knowledge of the risks of open burning whether in farms, backyards or in the process of wire reclamation. Furthermore, there is a need to raise more awareness among populations residing around medical waste incineration sites and waste dumps. Such residents are generally worried about black smoke and bad smell, but they need to know the real dangers of such smoke, and be able to raise their concerns at the appropriate government quarters.





Problems Identified

- Technical training on PCBs perception and hazards has not yet become widely available;
- Educational programs for exposed employees and workers are inadequate;
- Comprehensive PCBs training through mass media is still not available;
- Supporting programs for the promotion of public awareness on PCBs are not available;
- National as well as international mechanisms for information exchange and technological transfer are limited;
- Data records and database management systems on PCBs issues are absent.
- Dearth of information on past use of POPs pesticide.
- Lack of community awareness of past use of POPs pesticides and possible impacts.
- Lack of Data on possible residues in imported and locally produced food.
- Lack of awareness on possible residual impact of exposure to DDT among heath workers.
- Improper waste management, especially uncontrolled burning of solid waste.
- Inadequate enforcement of BAT requirements.

Action Plan	***Time Frame***
• Preparation of a plan for dissemination of relevant information on PCBs……	2008-2010
• Development of processes and procedures for participatory solutions to PCBs problems……	2007-2012
• Development and dissemination of PCBs related information in mass media…...……..	2007-2012
• Raising awareness on potential health risks and residual effects of previously used POPs pesticides …….…….……	2008-2025
• Raising awareness on proper management of pesticides…..…… …..	2008-2025
• Raising awareness on residual effects due to past use of DDT……..	2007-2010
• Ensuring better enforcement of regulation on BAT/BEP…….……	2008-2025
• Raising public awareness about the dangers and health risks of uncontrolled open burning of wastes……	2007-2025

Institutional and Legal Framework

Country Situation

In demonstration of its obligation to protect its citizens and environment from hazardous chemicals, the Sultanate of Oman issued the Law on Handling and Use of Chemicals under Royal Decree No. 46/95, and for purposes of enforcing this law, MECA, issued regulations for registration of hazardous chemical substances and the relevant permits by Ministerial Decision No. 248/97, dated 6 July 1997. The Permits and Records Section in the Department of Chemical Substances (MECA) is responsible for issuing permits for dealing with hazardous chemicals, including pesticides, in coordination with MOA, which controls the import and export of pesticides and prepares the list of banned and restricted pesticides.

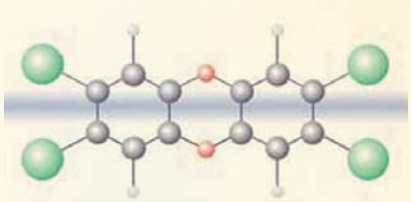
A Permanent Committee on Chemicals (PCC) was formed in accordance with Article (3) of the above mentioned law. The functions of this committee range from developing and implementing necessary regulations, through monitoring and dealing with violations, to collaboration with regional and international organizations for the enhancement of efforts to ensure that the use of chemicals do not jeopardize health and the environment.
Also, a Technical Committee on Chemicals (TCC) was formed according to Ministerial Decision No. 115/2000 under the chairmanship of the director of chemicals dept. in MECA, which is the main core of the Chemicals Permanent Committee for decision making.

Research and Development

Baseline Situation

In Oman, there are several laboratories which belong to governmental institutions and they work for specific parameters and purposes. The following provides information on these laboratories:

- Laboratory of the Ministry of Regional Municipalities and Water Resources works on analyzing pollutants in different media and food imported and produced in Oman.





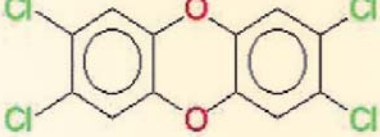
- Laboratory of the Ministry of Agriculture and Fisheries analyses chemical fertilizers and pesticides;
- Laboratory of the Ministry of Commerce and Industry analyses industrial chemical substances used for producing goods and items and verifies standard limits in the industrial products; it also controls and verifies chemicals limits in all kinds of goods that are trafficked and marketed throughout Oman and for import and export purposes;
- Laboratory of the Ministry of Health has the capacity to analyze chemical substances in drugs and pharmaceuticals.

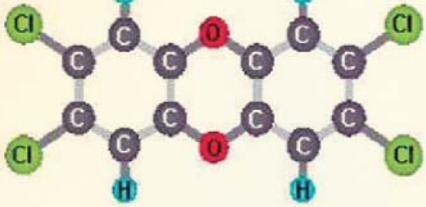
  However, there is no sufficient coordination among these, as each laboratory works for its own specific target and purpose while analyzing chemical substances. Furthermore, analysis results are kept for internal use only and are hardly shared with others, even when requests have been made. This is mainly because of the lack of a linkage among governmental ministries for the purpose of information sharing, especially, results of chemical analyses. Furthermore, each laboratory bears the responsibility of financing its own analysis and does not feel obliged to share its findings with others.

The estimation of the socio-economic impact of the NIP in Oman dwells on the following main spheres of operation, each detailing essential aspects such as environmental, health, social and economic implications as shown in the following table:

Table 2. Framework and Resource Requirements

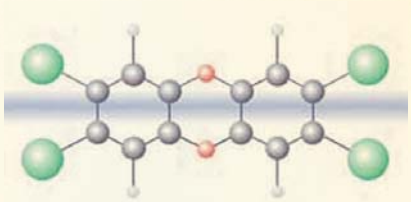
Activity	Environmental	Health	Social	Economic	Duration	Cost
Minimizing and Eliminating POPs by-products	Chemical analysis, enforcement of BEP, BAT, establishment of monitoring mechanisms	Provision of health care to exposed workers and local populations	Awareness raising and payment of compensation	Phase out of open burning sites and replacement with modern incinerators, installation of new special medical waste incinerator	2007-2012 2009-2014	65,460,000
Remediation of PCB contamination	Identification and testing of potentially contaminated sites, establishment of monitoring system, sound disposal of PCB, cleaning and rehabilitation	Testing and treatment of exposed workers and residents	Awareness and compensation	Phasing out PCBs-contaminated equipment, Replacement with PCBs- free transformers, strengthening of legislation, establishment of proper procedures for maintenance of PCB equipment	2006-2025 2008-2025	2165.000
POPs Pesticides	Identification, cleaning & rehabilitation of contaminated sites	Testing and treatment of affected farmers/ residents	NIL	NIL	2006-2025 2008-2025	80.000
DDT	Same as above	Provision of healthcare	Reconstruction, clean up of ceilings, walls	NIL	2006-2025 2008-2025	1.00000





Conclusion

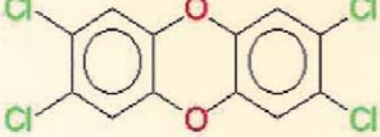
The elaboration Oman NIP is a product of multiple efforts and projects involving task teams of experts, consultants and representatives of the relevant stakeholders regarding POPs issues. The main efforts comprise the assessment of current realities in the Sultanate guided by relevant provisions of the Convention and with the assistance of consultants, inventories, review of documents and data bases, identification of priority problems and proposing of strategies and action plans as the case may be, for the achievement of set targets required of parties to the Convention. The main out puts include the national profile for assessing Oman's capacity to deal with chemicals, a thorough assessment of POPs-related issues in Oman, review of legislation and institutional capacities for implementation of such laws toward the management of POPs in accordance with international agreements, an inventory of POPs pesticide use in Oman, the assessment of equipment with potential PCB contents, an inventory of unintended by-products, an assessment of the risks of past indoor application of DDT, the identification of major problems and the determination of immediate action plans and long-term strategies together with time frame and costing of requirements for the realization of such goals, proposals on monitoring and data management, reporting and information sharing, research and development facilities, as well as the raising of awareness among various targets on the various aspects of POPs in Oman.

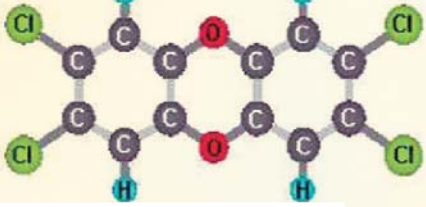




List of Acronyms and Abbreviations

AP	Action Plan
APCS	Air Pollution Control System
BAT	Best Available Technology
BEP	Best Environment Practice
BOOT	Build, Own, Operate, Transfer
COP	Conference of Parties
DDT	Dichloro-Diphenyl-Trichloroethane
DM	Dhofar Municipality
ESM	Environmentally Sound Management
EU	European Union
FAO	Food and Agriculture Organization
GCC	Gulf Cooperation Council
GDP	Gross Domestic Product
GEF	Global Environment Facility
IFCS	Intergovernmental Forum on Chemical Safety
ISO	International Standards Organization
LNG	Liquefied Natural Gas
MOA	Ministry of Agriculture
MD	Ministerial Decision
MH	Ministry of Housing
MOD	Ministry of Defence
MOG	Ministry of Oil and Gas
MOH	Ministry of Health
MOMP	Ministry of Manpower
MECA	Ministry of Environment and Climate Affairs
MSDS	Material Safety Data Sheet
MOTC	Ministry of Transport and Communications
NA	Not Applicable
ND	Not Determined/No Data
NGOs	Non-Governmental Organizations
NIP	National Implementation Plan
OCCI	Oman Chamber of Commerce and Industry
OETC	Oman Electricity Transmission Company
PAHs	Polyaromatic hydrocarbons
PCB	Polychlorinated-biphenyls
PCC	Permanent Committee on Chemicals
PCDD	Polychlorinated dibenzo-p-dioxins
PCDF	Polychlorinated dibenzofurans
PCU	Project Coordination Unit
PDO	Petroleum Development Oman
POPs	Persistent Organic Pollutants
PTS	Persistent Toxic Substances
PVC	Polyvinyl chloride
RD	Royal Decree
RO	Rial Omani
ROP	Royal Oman Police
SQU	Sultan Qaboos University
TCC	Technical Committee on Chemicals
TTPE	Task Team on Pesticides
UAE	United Arab Emirates
UNEP	United Nations Environment Programme





1. INTRODUCTION

One of the obvious imperatives of industrialization and mass production is the increasing use of chemicals whether they are pesticides used to enhance agricultural productivity, industrial chemicals employed in the manufacture of goods and services or even consumer chemicals ranging from food additives domestic cleaning solutions and solvents. At the same time, there is increasing evidence that such chemicals can constitute serious hazards to human health and the environment at various stages of their life cycle. These hazards may arise from pollution generated during the production processes, improper handling, or spillage during storage and transportation. They could also result from occupational accidents in the work place, or environmental contamination due to improper disposal methods. It was in due recognition of the increasing possibilities of chemical hazards that UNEP initiated the mobilization of the international community in 1995 to take immediate action towards addressing increasing threats posed to human health and the environment by chemicals, with particular reference to those classified under Persistent Organic Pollutants (POPs), also known as the dirty dozen, namely: *aldrene, chlordane, dieldrin, endrin, heptachlor, hexachlorobenzene, mirex, toxaphene, PCBs, DDT, PCDD and PCDF.*

To this end, IFCS was specifically tasked with producing an internationally binding legal instrument for implementing the international action. Following a series of meetings and negotiations, the Stockholm Convention on POPs was adopted and opened for signature in Stockholm, Sweden in May 2001 when it was signed by 92 states. The Convention, in Article 3.1, urges each party to:

(a) Prohibit or take legal and administrative measures necessary to eliminate:
  (i) Its production and use of chemicals listed in *Annex A,*
  (ii) Its import and export of chemicals listed in *Annex A,*

(b) Restrict its production and use of chemicals listed in *Annex B*

The Sultanate of Oman ratified the Convention in 2004.

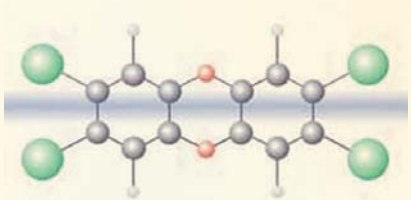
Oman's involvement with International Treaties Addressing POPs

With its rapid pace of modernization and development, driven largely by the need to diversify the economy beyond the oil sector, the Sultanate of Oman is currently passing through a stage of intensive industrial activity, accelerated by economic liberalization policies symbolized by government privatization programme, development of industrial estates and provision of handsome incentive packages for both local and foreign investments. At present, the focus is on increasing the contribution of non-oil sectors (including the gas industry) to the national revenue to 91% by 2020.

But Oman is at the same time conscious of the need to achieve a harmonious balance between agricultural, industrial and other development activities on the one hand, and safety of the environment and human beings on the other. Thus, even before officially joining the Stockholm Convention in 2004, Oman had in 1995 promulgated Royal Decree No.46/95 on the safe management of chemicals in general in the country. It had also signed the Basel Convention in 1994 and the Rotterdam Convention in 1999, all relevant to the management of chemicals in a safe and sound manner. The Ministry of Regional Municipalities, Environment and Water Resources is the focal authority charged with the responsibility of implementing the specifications of this Law with the collaboration of other ministries, authorities and establishments involved in one aspect of the life cycle of chemicals or the other. The signing of the Convention in 2002 represented an important international boost to its policies on environmental protection and conservation of natural resources, especially the safe management of chemicals in the Sultanate.

NIP Elaboration

In keeping with its international obligations regarding the Stockholm Convention, Oman undertook to launch its enabling activities towards ensuring that the necessary systematic approach was adopted in producing the Oman NIP. It received initial support for setting up the enabling activities from UNEP. Among the first steps taken in this direction included the assessment of national infrastructure and human resource capacity and the compilation of a national profile as a background for the implementation of the project. In order to shed





light on the baseline situation in the country regarding the various POPs issues addressed in the Convention, inventories were done on sources of POPs emissions, past use of DDT, PCBs equipment and wastes. Based on the reports emanating from these inventories, specific assessments were made of the actual situation of these chemicals on the ground and problems were identified. Subsequently, national priorities and objectives for POPs management were spelled out.

On the technical side, Oman sought the assistance of international consultants for guidance on the methodical structuring of the NIP elaboration as well as for the organizing of training workshops to enhance the capabilities of members of the Task Teams to discharge their responsibilities more efficiently. The consultants were very helpful in guiding the study of POPs situation in Oman and in proposing a detailed NIP structure. They also assisted in organizing the series of NIP planning workshops, guiding Task teams during the workshop and proposing a work plan, timetable and effective procedures to elaborate the NIP. They equally provided training on PCBs, By-products and DDT assessments.

The NIP was produced under a series of phases which include the following:

Project initiation: This phase featured inaugural meetings, the formation of task teams and specification of tasks as well as preparatory training workshops.

Assessment of socio-economic aspects POPs use in Oman: Major accomplishments of this stage include the drafting of the national profile, monitoring POPs pesticides DDT inventory, inventory of PCB equipment, risk assessment of past indoor use of DDT in Oman, identification of problems relating to the implementation of the Convention, and setting of priorities and objectives.

NIP elaboration: The elaboration process focused on how Oman intends to meet the requirements of the Convention, a review of regulatory and institutional capacity to implement the NIP, as well as infrastructure for monitoring, research and development, reporting and information exchange. The final and main aspect of the NIP was the elaboration of action plans and strategies as the pivot of the NIP.

Structure of the NIP

As a matter of structural requirement, The NIP begins with an executive summary that encapsulates the focal points of the NIP capable of standing on its own as a précis of the entire plan. Following this summary is the introduction which gives a background to the NIP, recalling the background, relevant provisions and objectives of the Stockholm Convention, in addition to serving as an overview of national POPs priority issues. The second major section set out as Chapter 2, gives baseline definitions in the form of the national profile for implementing the NIP such as institutions and legal framework, and an assessment of POPs problem in Oman.

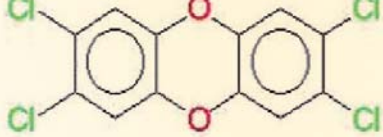
The final and key section (Chapter 3) details strategies and action plans with time frames and resource requirements.

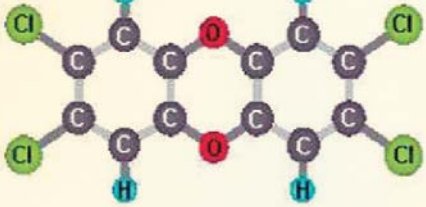
2 COUNTRY BASELINE

2.1 Country Profile

2.1.1 Geography and Population

Lying on the Tropic of Cancer in the extreme south eastern corner of the Arabian Peninsula, between latitude 16.40 and 26.20 degrees north, and longitude 51.50 and 59.40 degrees east, the Sultanate of Oman is situated in an area of major strategic importance in the Arabian Gulf region. Its coastline sprawls over 3165 kilometres from the Arabian Sea and the entrance to the Indian Ocean, to the Gulf of Oman and Musandam in the north, where it overlooks the Strait of Hormuz and the entrance to the Arabian Gulf. The Sultanate covers an area of 309,500 square kilometres, encompassing mountain ranges, arid deserts and fertile plains. Its borders lie with the Republic of Yemen to the south west, the Kingdom of Saudi Arabia to the west and the United Arab Emirates to the north. Apart from its serene islands such as Masirah and the Hallaniyat islands, Oman has





idyllic landscapes dominated for the most part by the Hajar mountain range, which forms a great arc extending all the way from the northwest towards the south east, and peaking in the Jebel Akhdhar area at an altitude of 3000 metres. The mountain rises to a height of 1,800 metres above sea level in Musandam, where the Strait of Hormuz lies between the Omani and Iranian coasts.

Climate

Much like its topographic diversity, the Sultanate's climate varies widely from humid coastal areas to hot dry desert interior. It is among the world's semi arid regions that depend heavily on rainfall for their water supply. However, not only is Oman's rainfall irregular with an average of 100 mm, but also around 80% of this quantity evaporates while approximately 5% flows into the sea. Providing a relief to this picture of aridity is the Dhofar province in the south, which benefits from the Indian Ocean monsoon that falls between June and September, giving rise to green vegetation cover and an exotic landscape that lures thousands of local and foreign tourists during the season known as *Khareef*.

History

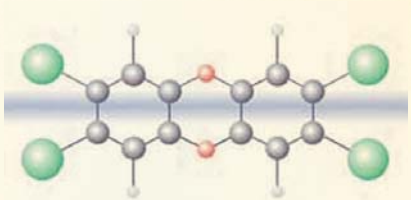
Historical accounts of the origin of Oman vary. While some writers say the country originated from Arab tribes who migrated to its territories from the Uman region of Yemen, some others believe it owes its name to Oman bin Ibrahim Al Khalil (Prophet Abraham). Whatever the case may be, an uncontroversial fact is that the earliest Omani tribes who settled in Oman were attracted by the abundance of natural resources which enabled them to make a living by fishing, herding or stock breeding. In addition to these elementary occupations, Oman had by the mid ages established itself as a prosperous seafaring nation, trading with merchants in distant destinations by dhows which set out from Sohar, which was perhaps one of the largest and most important cities in the Arab world.

Population

The 2003 population, housing and establishments census puts the population of the Sultanate at 2,340,815. Of this figure, citizens number 1,781,556 or 76.1% while expatriates make up 559,257 or 23.9% of the population. The census further shows that there is a total of 430,996 housing units and 343,377 households in the Sultanate. The following Table presents further breakdown of the census figures according to variables such as region, gender and nationality.

Table 3. Population per region/governorate

Region	Total Population	Total Omani			Total Expatriate		
			Male	Female		Male	Female
Muscat	632,073	381,612	198,719	182,893	250,461	173,197	77,264
Batinah	653,505	564,407	282,165	282,242	89,089	69,024	20,074
Musandam	28,378	20,324	10,824	9,500	8,054	6,308	1,746
Dhahira	207,015	147,689	74,337	73,352	59,326	43,842	15,484
Dakhiliya	267,140	235,337	116,638	118,699	31,513	25,393	6,140
Sharqiya	313,761	264,396	131,446	132,923	49,392	29,497	9,895
Wusta	22,983	16,861	9,035	7,826	6,122	5,615	507
Dhofar	215,960	150,959	77,376	73,583	65,001	49,823	15,178





2.1.2 Political and Economic Profile

Government and State Institutions

Over the ages, Oman has passed through a succession of dynastic rule including the Ya'ruba and the Al Busaid Dynasty of which His Majesty Sultan Qaboos bin Said is a descendant.

The present ruler, Sultan Qaboos acceded to power on 23 July1970 and with that came the beginning of a new era in Oman's history, one that would transform the country, fitting it for a place at the heart of the Gulf region and the modern world. The transformation, often referred to as the 'Blessed Renaissance', over the past three and a half decades, has seen the continued consolidation of national security, social stability and the rise of standard of living through the establishment of a comprehensive infrastructure including schools, roads, hospitals, efficient communications systems, services and industries which in turn has produced a generation of educated, ambitious Omanis capable of playing an effective part in their nation's continued development.

Administratively, Oman is made up of four governorates, namely; Muscat, Dhofar, Musandam and Buraimi, and five regions: Batinah, Dhahirah, Dakhiliyah, Sharqiyah and Wusta. These governorates and regions are further constituted of 60 districts or wilayats. Muscat governorate is Oman's political, economic and administrative capital. It is the most densely populated part of the sultanate with a population of more than 632,000 people spread over its six districts - Muscat, Mutrah, Bausher, Seeb, Amerat and Quriyat.

The Basic Law of the State as set out in Royal Decree No. 101/96 of 6 November 1996 lays down the legal framework governing the functions of the different authorities. It defines the scope of their functions in addition to separating their powers. The Law also defines Oman's system of government and the guiding principles behind the state's policies in various fields. Article 1 of the Law declares that the Sultanate of Oman is an independent, fully sovereign Arab, Islamic state, and that Islamic Sharia is the basis of legislation, while governance is based on justice, consultation and equality. The system of government is defined as a hereditary sultanate in which succession passes to a male descendant of Sayyid Turki bin Said bin Sultan. The State organizational structure comprises His Majesty the Sultan as the head of state, the highest and final authority in the land, and the supreme commander of the Armed Forces and the Royal Oman Police. Other state institutions include the Council of Ministers headed by the Sultan, the Council of Oman (Majlis Oman) made up of the State Council (Majlis a'Dawla) and the Consultation Council (Majlis a' Shura). The president and members of the State Council are chosen from Omani nationals based on their expertise, achievements or social standing, and their job is to facilitate governance by acting as link between government and the people. The Shura Council is: made up of elected representatives of the districts or wilayats, with districts holding 30,000 or less people electing one representative while those with more than 30,000 elect two. This body assists government in drawing up general policies.

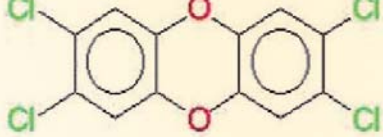
The overriding government philosophy is the development of the state through the sustenance of domestic security, stability and prosperity and the revival of Oman's traditional role in the region and wider world.

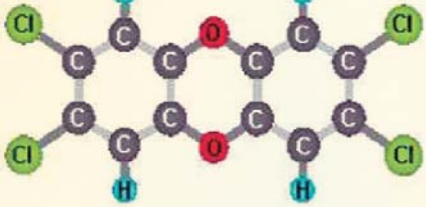
Judiciary

The Supreme Court is the apex court in Oman's judicial structure, and consists of a president and a number of deputies and judges. There are six courts of appeal which consider appeals against rulings delivered by lower courts, which themselves are responsible for ruling on civil and commercial cases, requests for arbitrations, and personal status cases

Economy

From an austere economy barely based on fishing, farming and animal husbandry prior to its renaissance, Oman is today a prosperous and dynamic economy The first 25 years of Oman's road to development were marked by major economic growth which were achieved through a series of five-year development plans beginning from the mid 1990s. Now in its seventh phase (2006 -2010) these development plans have served as platform for using available resources to create an Omani economy capable of sustainable growth. During the sixth development plan period covering 2001 to 2005, a total investment of US$12 billion was made particularly in industrial enterprise and it was not a surprise when GDP grew by 6.9% during the same period. For the





most part, major budgetary allocations go to education and health. In the 2005 budget, allocations for the two sectors totaled RO 627.6 million or 44%. Other areas of priority include development of human resources (RO 546 million or 15% of total expenditure), social security (RO 24.6 million), civil ministries' development projects (RO 330 million). For purposes of sustainability, soft loans (RO 66 million) were also granted to help boost private initiatives in agriculture and fisheries industries, tourism and private education. New projects, especially roads and extension of health care also got much attention (RO 238.2 million). More recently, based on the need to develop economic and human resources required to attain a strong diversified economy that is capable of taking a solid stand in the global economy, Vision 2020 was launched. It represents a projection of Oman's economic future that identifies and places emphasis on priority areas of economic development up to the year 2020. In all, Oman, today has a liberal economy and has succeeded in boosting its own potential as well as its ability to respond to developments in the Gulf region and the whole world. Government is currently taking active steps to implement the policy of privatization especially by opening up the electricity sector as well as communications, ports, industry, tourism and other areas to increased foreign investment. While encouraging the private sector and seeking to provide the best possible climate for attracting domestic and foreign investment, Oman is determined to ensure that local products are consistently in compliance with international specifications and standards. As a member of the World Trade Organization (WTO), Oman aims to strengthen its economic relations with other economic powers and blocs whether at the GCC or wider levels. The key sources of national revenue include the following:

Oil

Oman began oil exploration in 1967 when Petroleum Development Oman (PDO) was established as the major oil exploration and production company in the Sultanate. Today, PDO accounts for more than 90% of the nation's crude oil production and nearly all of its natural gas supply.

With a total reserve of crude oil and condensates standing at around 4,803.2 million barrels, oil is the major driving force of the Omani economy. For example, oil revenues accounted for RO 2,041 million or 65% of the estimated 2005 budget totaling Rial Omani (RO) 3,140 million. Revenues from other sectors amounted to RO 826 million or 26%.

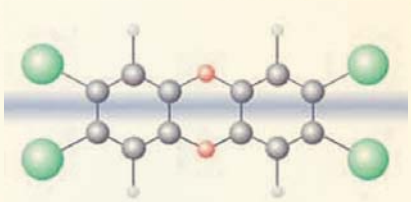
Natural Gas

Apart from crude oil, natural gas is increasingly proving its mettle as one of the Omani economy's most promising sectors and its contribution to the Sultanate's national income is continuing to grow. The Sultanate has proven reserves of 24.2 trillion cubic feet (tcf) and expected reserves of associated and non associated gas estimated at 33.8 tcf. In 2004 shipment of liquefied natural gas began with exports to the Far East and Europe, and currently, work is progressing to complete the construction of a third LNG plant in Qalhat, near Sur. In the 2005 budget referred to earlier, natural accounted for RO 273 million of national income, representing a rise by 9% compared with the previous period.

Mineral Resources

The mineral sector has a vital role in process of economic development in the Sultanate in respect of diversification of national income, creation of work opportunities and development of labour skills. Mineral raw materials exist in abundance in the Sultanate. These include Copper, Chromate, Manganese, Gold, coal, and industrial rocks and building materials such as silica sand, marble and limestone. Appropriately, the number of companies and corporations engaged in the production of minerals, building materials, as well as national industries, which depend on raw mineral materials available in the Sultanate, has risen to 360, offering employment to an estimated 9,000 people. Government has embarked on a programme to maximize the development of this sector by providing incentives to the private sector engaged in mining copper, chromite, nickel, iron, gold and silver. Unsurprisingly, this sector contributed around RO 12,4 million to the Sultanate's GDP over the first nine months of 2004.

Beyond the need to tap these resources, the Sultanate has made remarkable progress in respect of ensuring that these activities exert minimal impacts on the environment by adopting exploitation procedures through internationally rated scientific methods, which include a geological base of topographic maps, aerial photographs and geological, geophysical, geochemical and mineral maps. Of prime importance is the need to check the





possibility of these activities emitting unintended POPs by-products. The Table below shows quantities of minerals produced from 1995 to 2000.

Table 4. Mineral Production (metric tons x 1000)

	1995	1996	1997	1998	1999	2000
Marble	108	121	115	166	188	148
Limestone	2,206	2,262	1,983	1,902	3,809	3,497
Gypsum	104	113	123	165	180	132
Salt	14	12	13	14	11	12
Chromite	5	15	18	30	26	15
Gold	611	595	577	569	884	1,029
Building material	15,419	16,370	16,645	11,242	15,682	22,448

Trade

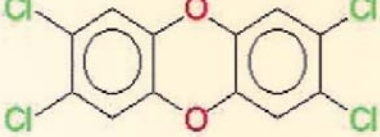
The Sultanate's strategic location remains important to world trade and shipping routes. The government of the Sultanate of Oman is keen to capitalize on this advantage by forging ahead with programmes to improve international trade links through membership of Arab and international economic blocs. Most significantly, Oman's ports are undergoing rapid expansion and modernization to ensure increased investments through increased volumes in trade and export of Omani goods. Work began on the first phase of the Salalah Free Zone infrastructure at the cost of 4.4 million in March 2005, and more free trade zones will be set up in selected locations under the 7th five-year plan. These investments are already reaping handsome benefits. For example, foreign trade rose to RO 6,988.4 million between the end of October 2003 and end of October 2004 representing a rise of 22%. Within the same period total imports rose to RO 2,748.8 million, a rise of 34.5%. It is estimated that about 20% of Omani products are exported to Asian markets, and about 18% to the United States, but the most products, especially non oil goods go to the Gulf Cooperation Council states especially the United Arab Emirates.

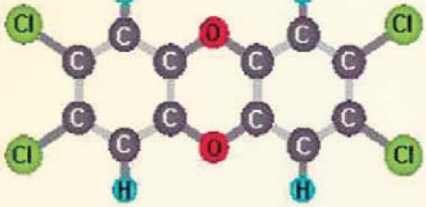
Commerce

In view of the great importance attached to commerce, efforts were intensified to promote national products with-in Oman through an exhibition inaugurated by His Majesty the Sultan in November 1998.

In order to facilitate importation via the Sultanate's various border checkpoints, the increase in customs duties in 1999 was abolished with effect from the beginning of 2000 and the distributor agency system was also abolished. Actions were taken to implement the intellectual property rights laws enacted under Royal Decree No. (47/96) in may 1997. The Sultanate also joined the Paris Convention on Protection of Industrial Property and the Berne Convention on Copyright Protection as from April 14th 1995 and due to increase in foreign investments in the Sultanate, the capital of registered companies in 1999 amounted R.O 8,950,000 equal to US$ 23 million and the number of companies rose to 25. UAE ranks top among the major commercial partners of the Sultanate followed by Japan, Britain, USA, Italy, Germany, France, Kingdom of Saudi Arabia, India and China.

In all commercial dealings, there are clear specifications regarding the importation and exportation of certain products, especially hazardous chemical substances regulated under Royal Decree 46/95. Oman joined the Basel, Rotterdam and Stockholm Conventions in 1994, 1999 and 2005 respectively, and as part of its determination to fulfill the obligations of these Conventions, RD 46/95 empowers the Customs Department of ROP to monitor and prevent the movement of prohibited chemicals in general and those prohibited under the relevant Conventions across its borders.

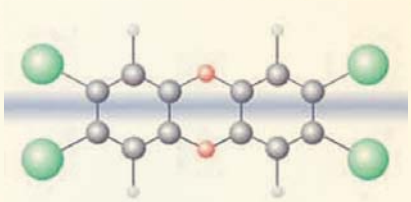




The number of Omani business organizations whose products pass freely through the GCC States in 1998 exceeded (35) companies and factories. It is worth mentioning that trade with the group of countries overlooking the Indian Ocean is on a continuous rise. It is also remarkable to state here that the Sultanate became a member of the World Trade Organization in 2001.

Summary of Basic Facts

Form of Government:	Sultanate
Capital:	Muscat
Area:	3,09,500 km^2
Administrative Structure:	Governorates (4),
Official Languages:	Arabic and English
Religion:	Islam
Total Population:	2,577,062
Urban Population:	11%
Rural Population:	89%
Average Age:	25-29 years
Working Population:	65%
Percentage of Women working outside home:	20.82% (in 2002)
Currency:	Rial Oman (R.O) = US$ 2.58 (387 Baisa = 1US$)
Measurement:	Metric
Time:	4 hours ahead of GMT
Electricity:	220 volts
Oil Production:	about 956,000 barrels a day
Oil Reserves:	5.8 billion bar (confirmed reserves)
Natural Gas Reserves:	about 24.4 Trillion cubic feet for 2001 (confirmed reserves)
Copper Reserves:	about 15 Million tons
Fish Stock:	4.7 Million tons
Birth Rate:	25.6 per 1000 population
Life Expectancy:	73.8 years
Literacy Rate:	73.6 % (in year 2000)
Education:	616,829 boys and girls (aged 18 years) are currently receiving education at various schools
Average Education level of Population:	Intermediate
National Day:	18th of November every year
Gross National Income:	(GNI) R.O. 7331,8 Millions (2000 market prices
Gross Domestic Product:	(GDP) =R.O. 7622,8 millions (2000 market prices
Main Administrative Regions:	9 (Regions 5 and 4 Provinces)
States: (wilayates)	61
Municipalities:	9





2.1.3 Profiles of Economic Sectors

Agriculture

Farming and fishing are two of the oldest occupations in Oman with over 200,000 Omanis engaged in farm work. Thus Agriculture and fisheries sector is of key economic and social importance for food self sufficiency and employment of national manpower. At the end of 2004 agriculture and fisheries contributed RO 161.8 million to GDP. Agricultural products range from dates through fruits and vegetables to frankincense and livestock (poultry, camels, cows and goats) with the total population of livestock reaching 1.8million head in 2003.

The fisheries sector is second only to oil and hydrocarbon products in importance. Because of the Sultanate's proximity to the Arabian Gulf, the Arabian Sea and the Indian Ocean, fishing is not only one of the country's oldest traditional occupations, but a major pillar of the economy and livelihood today. The sector currently employs over 32,369 licensed fishermen. Catches in 2007 totaled 278,000 tonnes with a value of around RO 64.8 million.

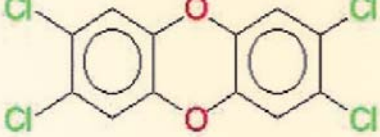
Although agriculture has taken advantage of modern techniques and machinery, its traditional nature in the past did not encourage the use of POPs pesticides, hence there is no evidence that the prohibited POPs pesticides existed anywhere in the Sultanate. Relative to DDT, it had been used in indoor applications for the eradication of malaria in some communities from 1976 to 1992. Beginning from 1992 DDT the use of DDT was stopped (except for some isolated uses for the control of sand flies from 1994 to 1998) until it was completely banned in Oman by MD 316/2001. Since 1998 DDT has been completely replaced by organophosphates and synthetic pyrethroids, and up till date there is no available stock and none has been imported into the country ever since.

Industry

There has been a significant increase in investment in industry along with a corresponding rise in its contribution to Gross Domestic Product. Priority is on the use of national resources in industrial operations across the country. Accordingly, industrial estates have been established where activities are in full gear. The Rusayl industrial estate, for example, has 140 factories while Sohar industrial estate has undergone huge and rapid development, and the Sohar industrial port has assumed wider roles in the importation and exportation of goods. Huge industrial projects in Sohar include the Sohar Refinery Company, the Sohar International Urea and Chemical Industries, Oman Methanol Company, Sohar Power Company and the Sohar Aromatic Company. Others are the Aluminium Smelter, Steel, Polypropylene and Polyethylene plants. In other areas, major industries include the Qalhat, Oman-India Fertilizer Company in Sur, which began production in 2005 and the Qalhat LNG plant which became operational in early 2006. More than RO4.65 billion (US$12 billion) investment was made in Sohar alone, and at the end of 2004, industrial production rose to 1,226.2 million, a quantum leap of 21% compared with previous year. The industrial sector's contribution to Oman's GDP totaled RO 776.7 million by end of 2004.

In order to consolidate these gains, Government continues to woo small scale industries with incentives which include low interest investment loans. There are currently approximately 4,700 industrial establishments in Oman. In order to ensure quality control, regulations are in force to ensure that products are in compliance with specifications of the International Standards Organization (ISO). To this end, a certification section has been set up in the Ministry of Commerce and Industry's Directorate General of specifications and standards.

Perhaps, of all sectors, industries have the greatest bearing on the objectives of the Stockholm Convention. A major implication of the rising pace of industrial enterprise in Oman must be the corresponding increase in the utilization of chemicals whether as fuels for power production, or in the production of chemical consumer products, pharmaceuticals, food additives, or in the manufacture of agrochemicals and materials for water sanitation. In Oman the biggest users of chemicals are likely to be petrochemical, agrochemical, mining, welding, printing and mechanics industries. Apart from the direct use of chemicals, the production processes are often known to lead to the unintended release of hazardous emissions which pollute the environment and pose serious hazards to human health and the environment.



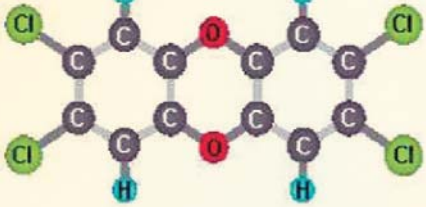


Table 5. presents the major industrial sectors in Oman.

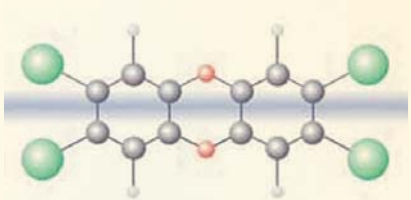
Description	Number of Facilities	Number of Employees	Output Value per year	Major Emissions
Food Processing	164	6902	1,71,977	Fats & Oil
Textile/Clothing & Leather	8	504	7188	Dyes, Cr, Salts
Wood/Wood Products, Printing	142	3264	53814	Inks, Solvents
Paper/Paper Products	10	620	11561	Inks, Sulphides
Chemicals/coal/Petrol/Plastic Products	82	2913	850919	NOx, CO, HC, CO2, SOx
Non-Metallic Mineral Products	243	6215	99417	N/A
Basic Metals	10	1154	48394	CO, CO2, NOx, SOx
Fabrication of Machinery & Equipment	16	4392	11934	Cutting Oils
Other manufacturing Industries	182	504	94194	CO, CO2, NOx, SOx
Mining & Extraction (Coal/Oil/Natural Gas/Minerals/Metals)				Cyanide, Acids, CO2, NOx, SOx
Electricity Generation	50	787		CO2, NOx
Dry Cleaning				Solvents Residues

In addition to the primary copper and aluminium industry mentioned earlier, other major sources of unintentional releases of POPs by-products in Oman are municipal and hospital waste incineration, thermal power plants and open burning of wastes. Ship waste may also constitute an additional burden to Oman's waste management systems, while chemical industries such as those dealing with the production of plastics, urea, sulpho-chemicals and chlorine as well as the oil-producing sector have potential to emit POPs by-products such as Oil hydrocarbons, including PAHs and unintentional by-products of combustion and industrial processes.

In order to protect people, especially factory workers where chemicals are either manufactured or used, the society at large and the environment, from immediate and long-term impacts of exposure to chemicals, Royal Decree 46/95 on handling of chemicals imposes on MECA the duty to ensure that the manufacture, import, export, transport, storage, handling, use and disposal of all chemicals within the Sultanate are done in accordance with national and international safety regulations.

Power Production, Transmission and Distribution

Electrical power in Oman is generated by 49 power plants with a total production capacity of 3,024 megawatts. In 2004 these plants together with imports from other sources, generated 11,494 gigawatts per hour, representing a 7.3% increase on 2003 figures. Construction of the Sohar power station and desalination plant was completed in 2006 and work is continuing on the Oman-UAE power station project and in June 2004 an agreement was signed on a power link between the two countries as part of the power link between the GCC states. The Privatization Law was promulgated under Royal Decree No 77/2004 marking the Sultanate's significant step in the implementation of its privatization policy. The Decree regulates the privatization of the electricity and water sector. Under the new dispensation, there are government owned companies established under the law for the generation and distribution of power, namely the Electricity Holding Company (SAOG), the Gubrah Power and Desalination Company (SAOG)., the Rusayl Power Company (SAOG) the Wadi Al Jizzi Power Company (SAOG), Mazoon Electricity Company





(SAOG), Majan Electricity Company (SAOG), Muscat Electricity Distribution Company (SAOG), and the Oman Electricity Transmission Company (SAOG), Oman Power and Water Purchasing Company (SAOG) and the Rural Arcas Elec Co (RAECO). An independent authority regulates and monitors this sector. There are also four privately funded power projects operating in Oman, namely, Manah Power Plant established in 1996, which, with its five gas turbines, provides a total of 270 megawatts, the Al Kamil Power Plant, which has gas turbines with total capacity of 290 megawatts, Barka Power and Water Desalination Plant with a combined cycle plant including two gas and one steam turbines with a total capacity of 427 megawatts, and a water desalination plant with a capacity of 20 million gallons per day. The Dhofar Power Company has a plant with 8 gas turbines with a capacity of 242 megawatts and 132 KV transmission system. Oman's domestic voltage is 220 volts.

Transformers filled with PCBs or PCBs contaminated dielectric fluids, capacitors, voltage regulators, liquid-filled circuit breakers and other electric equipment containing dielectric fluids are potential sources of PCBs exposure and environmental pollution, which pose serious threat to human health and the environment, especially in the case of leaking transformers. Burnt transformers are equally dangerous with the possibility of releasing furans and dioxins. During the process of the NIP elaboration an inventory of transformers in Oman was done and a database created which holds information on transformer details such as the weight, mark, year of manufacture, capacity, location, and assumption of PCB contamination. Other potential sources of PCBs in Oman include contaminated solvents/water, used oil and waste oil, sludge and slurries, contaminated soils and sediments, scraps, ballasts, and other materials contaminated with PCBs as a result of spills, decommissioning or other demolition exercises.

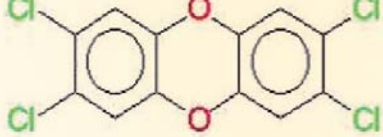
2.1.4 Environmental Overview

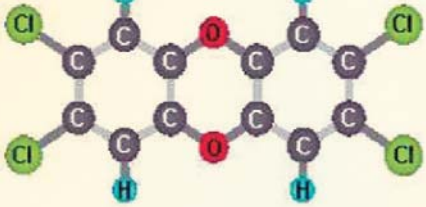
Fully aware of the potential of social and economic developments to take a toll on the environment, the Sultanate of Oman has gone to great lengths to ensure protection and conservation of the environment. The first step in this direction was taken in 1979 with the establishment of the Council for the Conservation of the Environment and Prevention of Pollution by Royal Decree No.68/79. The sole responsibilities of this Council can be summarized in the contents of the Law on Conservation of the Environment and Prevention of Pollution promulgated under Royal Decree No. 10 of 1982. The Law aimed basically at providing the greatest possible health and social welfare for the nation and its citizens, protecting its natural resources, preserving its historical and cultural heritage and minimizing long term damage or impacts likely to arise from development in a fast modernizing nation. The Law has since been superseded by Royal Decrees No 114 of 2001 (Conservation of the Environment and Prevention of Pollution) and No.115 of 2001 (Protection of Water Resources from Pollution)

Further underscoring the importance of shepherding the environment, Government promulgated Royal Decree No. 45/84 in 1984 which enabled the creation of a full Ministry of Environment, the root of the present Ministry of Environment and Climate Affairs. In addition to providing essential municipal services to citizens and residents, MECA is charged with the responsibility to:

-Protect human beings and the environment from all sources, types and impacts of pollution
-Conserve the nation's natural resources and protect them from depletion and degradation
-Protect wildlife
-Regulate sound environment rules and prevent violations
-Establish environmental awareness programmes to address all levels of society
-Enhance regional and international cooperation in implementing Conventions and treaties related to various aspects of environmental protection.

So far, the Sultanate of Oman has come a long way in its rising credentials as a nation that cares for the environment. Not only has it supported and participated actively in regional and international forums aimed at finding common solutions to global environmental problems, it has also acceded to or ratified several important Conventions, Treaties and Laws on environmental safety, such as the Stockholm Convention on POPs, the Basel Convention on the Control of Trans-boundary Movement of Hazardous Wastes and their Disposal, and the Rotterdam Convention on Prior Informed Consent for certain Hazardous Chemicals in International Trade. Oman ratified the Stockholm Convention in 2004, the Basel Convention in 1995, and joined the Rotterdam Convention in 1999.





2.2 Institutional, Policy and Regulatory Framework

2.2.1 Environmental/Sustainable Development Policy and General Legislative Framework

Using chemicals in modern industry has become increasingly indispensable for the development of the economy of most countries. However, there is an equally growing consciousness that the use of such substances requires sound management in order to prevent their adverse impacts on human health and the environment. The Sultanate demonstrated its commitment to protect its citizens and its environment against the dangers of these substances by promulgating the Law on Handling and Use of Chemicals under Royal Decree No.46/95. The decree complements the policy of sustainable development in the Sultanate as enunciated in the Law on the Conservation of the Environment and Prevention of Pollution (Royal Decree 114/2001). The prime item controlled by RD 46/95 is the Chemicals List, a comprehensive description of the nature, use, status, user, and movement of chemicals in Oman. Chemical use in Oman is distributed within various sector as shown in table 6. The list is updated regularly in compliance with the latest developments relating to the relevant Conventions that Oman is party to. In order to deal with the importing, exporting, transporting, storing, distribution, use and disposal of chemicals in the sultanate of Oman, it is obligatory for all concerned parties to register the entire list of chemicals that they deal with. In order to obtain a permit to handle chemicals, the following documents are required:

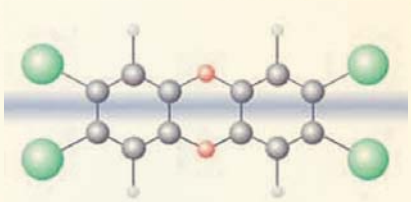
- Covering letter.
- Original copy of the Material Safety Data Sheet (MSDS) from the manufacturer.
- Completed registration form.
- Civil Defence permit to store and transport chemicals.

The Law requires MECA as the main authority overseeing all activities dealing with chemicals beginning from production to disposal to establish a Department of Chemicals.Towards the enforcement of the Decree, MECA issued the Regulations for the Registration of Chemical Substances and the Relevant permits in Ministerial Decision No. 248/97 on July 6th 1997.

Table 6. Categories of Chemicals Used in Oman

Type of Chemical	Quantity Used Per Year
Pesticides (Agricultural use)	30,500 litres (2002)
Pesticides (Public Health)	About 1% chemical =4487 kg About 50% chemical = 6089 kg
Pesticides (Consumer Use)	No information
Fertilizers	No information
Petroleum Products	1,670,880 BBL
Industrial Chemicals (used in manufacturing/processing facilities)	No information
Consumer Chemicals	No information
Other Chemicals	No information

In compliance with Article 3 of Royal Decree 46/95 which requires the formation of an inter-ministerial committee responsible for drafting regulations and decisions regarding manufacturing, importing, exporting, transporting, storing, handling and use of chemicals in the Sultanate of Oman, MECA established The Chemicals Permanent Committee. The preliminary task of this Committee was to provide a more detailed picture of the chemicals status in the Sultanate of Oman through inventories and other means and promote public awareness for the safe use of chemicals.





The main functions of the Committee include:
-Developing and following-up the necessary regulations and decisions to implement the law on Handling and Use of Chemicals according to the laws in force in the Sultanate and in international organizations.
-Collaborating with the agencies concerned with developing the procedures and conditions for chemicals manufacture, import, export, transport, storage, handling and use, and disposal.
-Investigation and stoppage of the activities of violators who manufacture, import, export, transport, store, handle or use any hazardous chemical that endanger public health and the environment, according to a recommendation of concerned authorities.

The core of the Permanent Committee is the Technical Committee formed according to Ministerial Decision No. 115/2000 and headed by the Director of Chemicals Department in MECA. Broadly, the Committee studies all technical issues related to chemicals before submitting recommendations to the Permanent Committee for decision-making.

The Technical Committee carries out the following responsibilities:
-Carrying out inventories and registration of hazardous chemicals and the agencies using them as well as collecting the relevant data.
-Establishing a database on chemicals.
-Classifying chemicals according to local and international specifications.
-Monitoring hazardous chemicals (for example, the Committee carried out a survey on Asbestos in the Sultanate and monitored and analyzed paint and ink samples to determine concentrations of heavy metals, especially lead (Pb), as well as making sure that they do not contain any PCBs).

Furthermore, the Committee monitors other kinds of hazardous chemicals in the environment, whether pesticides or synthetic chemicals. In this respect, it is also responsible for:
-Implementing the ban on hazardous chemicals, especially POPS.
-Testing chemicals to determine the level of their toxicity.
-Developing guidance programs and rules for training staff working in the chemical domain.

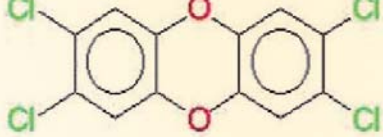
It is important to note here that chemical wastes in Oman are managed within the context of a Hazardous waste management "umbrella." In early 1993, the first major step to address concerns over hazardous waste management across the country was implemented in the form of the first "Regulation on Hazardous Waste Management in Oman."

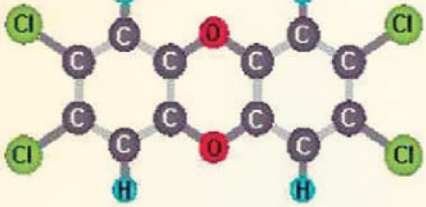
National inventories on hazardous wastes in Oman were carried out in 1996 and 2001 which identified the types and sources of all hazardous wastes being generated plus all those in storage and awaiting disposal. They also included projected estimates of future quantities and types of wastes likely to arise from known or projected development projects in the country.

The non-availability of appropriate or sufficient facilities to manage most categories of existing and newly procured quantities of hazardous waste meant that it was often necessary to utilise stop-gap methods. In some cases, it was inevitable that unsatisfactory situations existed and unsound disposal and / or chemical waste management was not uncommon. Additionally, the lack of suitable facilities made it extremely difficult to implement effective legislative control.

However, the situation has been reached today whereby all major hazardous wastes streams, including the waste chemicals, are inventoried, legislated and are under acceptable control. Temporary arrangements are in place for the management of some critical situations and final tendering arrangements have been put in place by the Government to implement a "cradle to grave" National Hazardous Waste Management Project that will be operated on a "BOOT" basis by a privatised concession for all wastes that require treatment and disposal.

Relative to capacity for implementing the NIP, MECA has a Central laboratory that conducts analyses of chemical samples and databases for processing data on imported chemicals and agencies dealing with such substances. The





Ministry also collaborates with many international and regional organizations and agencies to access data on chemical substances.

There is considerable expertise available outside the government in respective fields. A number of organizations indirectly take part in the management of chemicals. They are considered as the government counterparts. These organizations are identified as professional organizations, universities, industrial associations, environmental / consumer groups and other non-governmental organizations. They can share information, and provide ideas and suggestions to the government, but they have no authority to make official decisions..

2.2.2 Roles and Responsibilities

Ministerial Authorities and Mandates

For the effective implementation of the National Umbrella Act on the management of chemicals as well as the implementation of NIP on management of POPs, various aspects of the life cycle of chemicals are monitored through a variety of concerned government authorities.
MECA oversees all activities dealing with chemicals beginning from production to disposal and deals with assessing the direct effects of releasing chemicals into the environment as emissions and wastes to air, water and land. It is also responsible for:
Issuing permits for the import, export, storage, and handling of chemicals.
Ensuring Occupational and Environmental Safety.
Inspecting all companies dealing with chemicals.

The Ministry of Agriculture controls and monitors the use agricultural chemicals for increased productivity and registers and monitors all pesticides allowed for use in Oman.

The Ministry of Health monitors all pharmaceuticals to ensure they comply with regulations on chemicals, and assesses short- and long-term health impacts of chemicals. Furthermore, the Poison Control Centre of the MOH is in charge of monitoring poisons of all types.

The Ministry of Manpower deals with occupational health and safety issues related to use and handling of chemicals in the workplace.

The Ministry of Oil and Gas in keeping with government specifications on environmental protection, monitors and evaluates its emission activities.

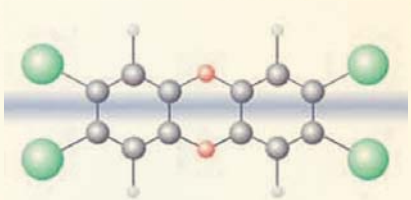
The Ministry of Commerce and Industry is concerned with the production or use of chemicals and chemical products and the introduction of cleaner production technologies, as well as import and export of chemicals It keeps a register of all companies dealing with chemicals.

The Ministry of Legal affairs takes care of drafting legislation and regulations.

The Natoial Commmittee for Civil Defence Lssues permits for the storing and transport of any chemicals and helps in any chemical accidents.

Royal Oman Police is tasked with ensuring that chemicals do not enter or leave the country contrary to government regulations
The Sultan Qaboos University (SQU) provides intellectual and research expertise.

Inter-ministerial Commissions and Co-ordinating Mechanisms
As mentioned earlier, the role of inter ministerial committees are considered paramount in the effective implementation of the Law on chemicals and the implementation of the NIP. The two main committees established under Royal Decree 46/95 for this purpose are the Permanent Committee on Chemicals (PCC) and the Technical Committee on Chemicals (TCC).





The PCC comprises the undersecretary for Environmental Affairs at MECA as chairman and members of the rank of Director-General drawn from ROP, MECA, MOD, MOA, MOH, MOG and Sultan Qaboos University (SQU). The Committee is responsible for:

-Drafting regulations and decisions required to enforce the Law and monitor their implementation.

-Developing the procedures and conditions for manufacturing, importing, exporting, transporting, storing, handling and use of chemicals, as well as the disposal of their waste, in coordination with the concerned agencies.

-Based on recommendation of the Department of Chemicals, investigating and suspending violators of the Law from manufacturing, importing, exporting, transporting, storing, handling or using any chemical that pose threats to public health and the environment.

The Technical Committee on Chemicals (TCC) is chaired by the Director of Department of Chemicals, MECA, and members are selected from (ROP), MECA, MOD, MOA, MOH, MOG, and SQU. Its responsibilities include:

-Classifying hazardous chemicals

-Preparing inventories and registers for chemicals in the Sultanate of Oman

-Preparing conditions for handling chemicals

-Drafting regulations and suggesting punitive measures for violations against the Law on Handling and Use of Chemicals.

The Safety and Occupational Health Committee (SOHC)

The Safety and Occupational Health Committee was formed in 2004 and is chaired by the Undersecretary for manpower in the Ministry of Manpower (MOMP). Its other members are from MOMP, ROP, MECA, Ministry of Transport and Communication (MOTC, MOH) Muscat Municipality (MM), Dhofar Municipality (DM) Oman Chamber of Commerce and Industry (OCCI), Associate Committee for Oil and Gas Sector (ACOGS), Associate Committee for Instructional Sector (ACIS), and Petroleum Development of Oman (PDO). The duties of SOHC include:

-Preparation of the national plan for safety and occupational health which includes:

-Suggestion of the general policy for safety and occupational health in the private sector establishments.-Proposals for public awareness

-Review of major work accidents and suggestion of preventive measures

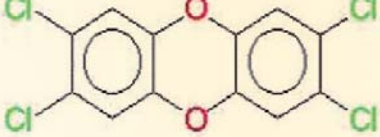
Mechanisms for Obtaining Input from Non-Governmental Bodies

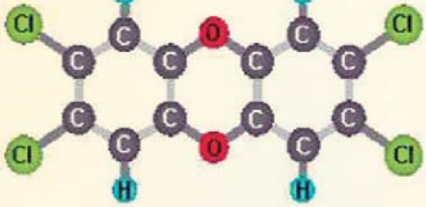
It is the policy of the Sultanate of Oman to involve all stakeholders in formulating environment policies and programs. SQU is strongly involved in the decision-making processes of the national chemical management programs and policies and was chosen to represent the education and research sector. Entities that represent the industrial sector such as General Establishment for Industrial Estates and NGOs such as Consumer Protection Association will be invited to join **PCC** and **TCC** in the near future.

2.2.3 Relevant International Commitments and Obligations

The Sultanate is a party to Conventions that address issues related to POPs chemicals, such as:

The Rotterdam Convention.
The Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and their Destruction.





The Basel Convention.
The Regional Protocol on Trans-boundary Movement of Hazardous Waste.
The Stockholm Convention on POPS.

2.2.4 Principles of Existing Legislation and Regulations addressing POPs

At the National level, the following regulations are meant to enhance the implementation of the NIP

RD 114/2001 - Conservation of the Environment and Prevention of Pollution

RD 115/2001 - Protection of Water Resources from Pollution

RD 46/95 - Handling and Use of chemicals (national umbrella Act covering all chemicals)

MD 316/2001 - prohibits certain chemicals including PCBs and DDT (covers direct use of PCBs but does not regulate PCBs in sealed equipment)

MD 18/93 - regulates Management of Hazardous Wastes (relevant to management of PCBs contaminated waste, defines transformer oil as hazardous waste)

MD 317/2001 - regulates Labelling and Packaging of Chemicals

MD 248/97 - regulates Registration of Chemical Substances and the Relevant Permits

MD 17/93- regulates Management of Non Hazardous Waste.

All legislation on chemicals are published in the Official Gazette and registers as well as in the press, television and radio. Public awareness is also provided by means of lectures to various sectors of the local community (schools, women's groups etc)

2.2.5 Key approaches and procedures for POPs Management

Use of Persistent Organic Pollutants in Oman:

There is not much official data on the use of any of the persistent organic pollutants (POPs) included in the Stockholm Convention. However, it is assumed that there was neither extensive use nor heavy need for the application of pesticides in Oman agriculture before the eighties. Since 1980 chlorinated hydrocarbon pesticides have been excluded from the recommendations of Ministry of Agriculture and substituted by organophosphorous and pyrethroid pesticides (Pesticides used in Oman, Extension Bulletin no. 26, 1983). However, in one of FAO reports, it has been mentioned that the average of pesticides used in Oman during the period 1980 to 1990 is 57,000 tons. Actually this figure represents the average of all pesticides which have been imported to Oman in that period. More than half of those pesticides have been re-exported to neighbouring countries. However, personal communications revealed the following:

Endrin, Aldrin and BHC (synonym=hexachlorocyclohexane) had been used in a limited scale before 1977. Most of the use was by spraying on to nursery soils for the control of grass hoppers. It has also been used by farmers to control pests around houses.

Bidrin was used for the control of certain insects on vegetables and field crops. This was mentioned in the Annual Report of Agricultural Research (Plant Protection Section, 1976-1977).

No evidence was found on the use of other POPs pesticides that are included in Stockholm Convention in Oman.

Present use of POPs pesticides

In the mean time, as the effect of pests and diseases became more pronounced, crop protection measures, including pesticide application, was deemed necessary. Table 5 shows the pesticides used in Oman, which were recommended and subsidized by the MOA in 1983 (Pesticides used in Oman, Ministry of Agriculture, Extension Bulletin no. 26, 1983).

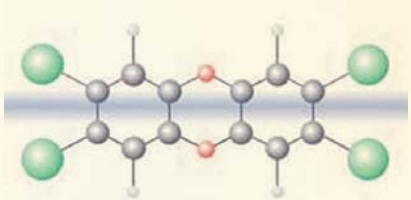




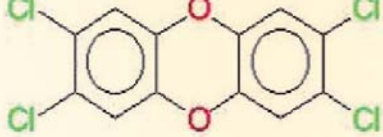
Table 7. The pesticides used in Oman which were recommended and subsidized by MOA in 1983

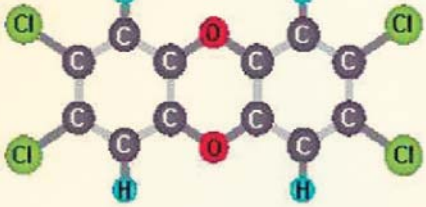
Pesticide type	Trade name	Common name
Insecticides	Permasect 25% EC	permethrin
	Primor 50% WP	primicarb
	Thuricide HP 16000 i.u. WP	b t
	Gardona 24% EC	tetrachlor phenefos
	Dimethoate 40% EC	dimethoate
	Diptrex 80% WP	trichlorphon
	Diazinon 5% G	diazinon
	Dimecron 50% L	phosphamidon
	Decis 25% EC	deltamethrin
	Sumithion 50% EC	phenetrithion
	Cimbush 10% EC	cypermethrin
	Furdan 5% G	carbufuran
	Kafil 10% EC	permethrin
	Croniton 50% EC	athiopheccarp
	Nogos 50% EC	dichlorovos
Fungicides	Cupper oxychloride 50% WP	cupper oxychloride
	Antracol 70% WP	propineb
	Perenox 50% WP	cupper oxide
	Tecto 40%	thiabendazole
	Dithane M 45 80% WP	mancozeb
	Sulphur WP	sulphur
	Milcurb super 25 %	athirmol
Acaricides	Omite 20% EC	perpargit
	Torque 50% WP	dialiphos
	Mitac 20% EC	amitraz
Nematicides	Nemacur 10% EC	phenamiphos
Herbicides	Gramoxon 20% L	paraquate
Rodenticide	Zinc Phosphide	zinc phosphide
Additives	Protein hydrolyzate	protein hydrolyzate
	Mineral oil	mineral oil

None of those pesticides are included in the Stockholm Convention List of Chemicals.

Obsolete stocks of POPs pesticides

A questionnaire had been distributed by MECA to pesticides dealers. Their response regarding the use or obsolete stocks of POPs pesticides was negative. From the records of MECA and MOA, Government officials responsible for issuing permits for pesticides did not find any use of POPs pesticides in Oman, hence also no obsolete stocks.





Contaminated Sites

No sites contaminated with POPs pesticides have been found. Since there are no records about extensive use of POPs pesticides in the past, it is assumed that there are no POPs pesticides contaminated sites in Oman.

2.2.6 Details of any relevant system on assessment and listing of new chemicals

The Department of Chemical Substances represented by Data and Licences Section is responsible for controlling pesticides. It issues environmental permits and maintains the database on chemicals. This section consists of:

Head of section
Three issuing staff
One data entry and archive staff

The Chemical Substances Database consists of:

- Registration Module
- Permit Module
- Queries and Reports
- System Codes
- Chemical Information Program
- Products Registration
- Security

Registration Module:

Contains company's information i.e. company's name, address, telephone number and fax number.

Permit Module:

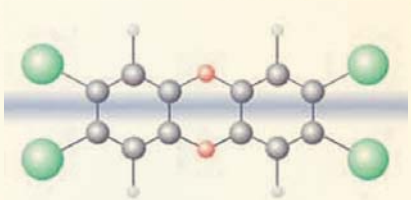
Contains information i.e. permit number, registration number, company name, issue date, expiry date, fees, trade name, imported quantity, approved quantity, usage, business purpose, storage location, manufacturing company and its address.

Queries and Reports:

Contains information i.e. materials dealt by all companies, materials dealt by one company, companies dealing
with material.

Integrated Pest Management

In order to minimize the use of pesticides the MOA carried out several pest management programs based on the results obtained by research centers. Surveys are conducted to assess the importance of various plant pests in Oman. Basic studies are carried out to understand pest biology and ecology in order to design proper management strategies. Important pest management strategies included the implementation of one or more management tactics after understanding pest behavior and damage. These include vector exclusion such as the use of plant covers to exclude white fly which is the vector of tomato yellow leaf curl virus (TYLCV). It also includes the use of naturally occurring natural enemies for the management of important pests like citrus black fly, mango midge, scale insects, coconut beetle, pomegranate butter fly, etc. Research activities are in process for the biological control of *dubas bug*, which is the economically important pest on date palm. Resistant varieties play very important role in the non-chemical and sustainable management such as resistant varieties for Witches' Broom Disease of Lime (WBDL).





2.2.7 Priority problems and objectives for institutional and regulatory strengthening

4.1 PROBLEMS

Following problems related to POPs pesticides have been identified

- lack of Studies on environmental and health impact assessment due to the past use of pesticides
- misleading labelling
- Non availability of data on chemical residues in food.
- There is no detailed information on the past uses and disposal of POPs pesticides
- Pesticide smuggling.
- Lack of community awareness of POPs use on the past and possible impacts

2.3 Assessment of the POPs Issue in the Sultanate of Oman

2.3.1 POPs pesticides

Introduction

In line with its determination to meet its obligations to the Stockholm Convention with regard to POPs Pesticides, the Government of Oman appointed the Ministry of Environment and Climate Affairs (MECA) as the focal point for the execution of the national project on evaluating POPS issues in Oman. Toward the realization of the goals of the project, a project coordination unit (PCU) was established that is responsible for managing the project on a day-to-day basis, especially the monitoring of the outputs, which would eventually contribute to the production of an NIP.

To ensure that the various aspects of the project were duly covered, task teams were formed to carry out the activities of the project and to elaborate its outputs. One of these is the Task Team on POPs Pesticides (TTPE).

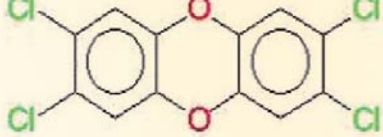
Under the Stockholm Convention, the task of the team covers the following POPs pesticides:

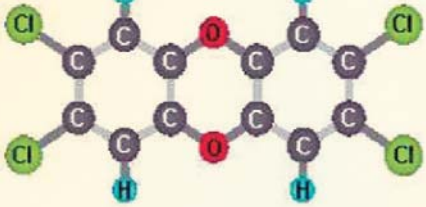
aldrin
chlordane
DDT (subject of a separate report)
dieldrin
endrin
heptachlor
mirex
toxaphene
hexachlorobenzene (This can be used as pesticide as well as an industrial chemical).

In order to carry out an inventory on the above mentioned POPs pesticides in Oman , TTPE gathered relevant information from the chemical database and from a nation-wide questionnaire survey of stakeholders. The database showed that from 1998 to the present no permits on POPs pesticides were issued. A review by the Ministry of Agriculture and Fisheries (MOA) further showed that Oman does not have stocks of those pesticides. The survey established that (with the exception of DDT) none of the above listed POPs pesticides had been used in the past and are not in use currently. Another inventory was done from 2001 to 2003 by inspecting pesticides markets which further confirmed the absence of these pesticides in Oman.

Relevant Stockholm Convention Requirements

With regard to **pesticides**, the Stockholm Convention concentrates on reduction of their production and use. Because of actual broad present uses of DDT for malaria control, possible exemptions for countries, combating vector-based diseases, are dealt with separately.





Following are the basic provisions:

1.a) i Each party shall prohibit and/or take the legal and administrative measures necessary to eliminate its production and use of the chemicals listed in Annex A

1.a) ii Each party shall prohibit and/or take the legal and administrative measures necessary to eliminate its import and export of the chemicals listed in Annex A

1.b) Each party shall restrict its production and use of the chemicals listed in Annex B (DDT)

2.a) i Each party shall take measures to ensure that a chemical listed in Annex A or Annex B is imported only for the purpose of environmentally sound disposal.

2.a) ii Each party shall take measures to ensure that a chemical listed in Annex A or Annex B is imported only for the purpose which is permitted for that party.

2.b) Oman has neither specific exemption under the Convention nor a reason to ask for it.

2.c) Each party shall take measures to ensure that a chemical listed in Annex A is not exported from it except for the purpose of environmentally sound disposal.

3. Each party that has one or more regulation and assessment schemes for new pesticides or new industrial chemicals shall take measures to regulate with the aim of preventing the production and use of new pesticides or new industrial chemicals which, taking into consideration the criteria in paragraph 1 of Annex D, exhibit the characteristics of persistent organic pollutants.

4. Each party that has one or more regulation and assessment schemes for pesticides or industrial chemicals shall, where appropriate, take into consideration within this schemes the criteria in paragraph 1 Annex D when conducting assessments of pesticides or industrial chemicals currently in use.

Parties shall: [Article 3, para. 1]

(a) "prohibit and/or take the legal and administrative measures necessary to eliminate":

(i) production and use of chemicals in Annex A[1] and

(ii) import and export of chemicals in Annex A

- i.e., trade is restricted [see paragraph (2)]

(b) "restrict its production & use" of chemicals in Annex B[2]

- "acceptable purposes" specified for these chemicals

Parties shall: [Article 6]

- develop and implement strategies to identify stockpiles [para. 1 (a)(i) and 1 (b)]
- manage stockpiles in a safe, efficient and environmentally sound manner (ESM) until they are deemed to be wastes [paragraph 1 (c)]

– i.e., no remaining uses by Party

• no specific exemption or acceptable purpose

– does not apply to stockpiles that may be exported

• per Article 3, para. 2

• develop strategies to identify [para. 1 (a)(ii)]

– products and articles in use, and

– wastes

1 Aldrin, Chlordane, Dieldrin, Endrin, Heptachlor, Hexachlorobenzene, Mirex, Toxaphene, Polychlorinated biphenyls (PCBs)

2 DDT

that consist of, contain or are contaminated with a POP in Annex A, B or C

- endeavor to develop strategies for identifying sites contaminated by POPs in Annex A, B or C[3] [para. 1 (e)], and
- if remediation is attempted, do it in an environmentally sound manner

The Situation in Oman

Before the 1980's, agriculture in Oman was practiced in a traditional manner. Local crop varieties were cultivated according to practices which mostly depended on inherited traditional wisdom, with limited use of machinery. Farm yard manure was used as the main source of nutrients for crops. Pests and diseases were not considered then as major constraints of agricultural production. The reason behind this could be due to the:

- use of crop varieties adapted to local conditions.
- limited introduction of exotic crop varieties to Oman which in turn limited the introduction of pests and diseases.
- limited transportation of planting material within different regions of Oman due to transportation and road constraints.

Based on the above reasons and because the agricultural lands in Oman were comparatively very limited, it was thought that there may not be a serious need for crop protection measures, especially the use of pesticides. In the eighties there was considerable development in the agricultural sector as is the case with all other sectors in Oman. Statistics of 1985 and 1990 revealed that agriculture had intensified with cultivated areas increasing by 15.4% and productivity of fruit trees by 13.8%.. The area taken up by the cultivation of vegetables had also increased by 23.2% while productivity of vegetables had increased by 42.2%. Relative to field crops, the area of cultivation had risen to 38.3% while production had increased by 39.4%. This was as a result of the introduction of agricultural machineries, crop diversification and high yield varieties. For example the data presented in the Table below shows a comparative picture of the progression in area (in hectares Ha) and production (Ton) of agricultural activity in Oman between the years 1985 and 2003.

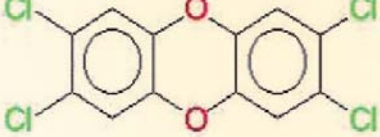
Table 8. Comparison of area (Ha) and agric production (mt) in Oman between 1985 and 2003.

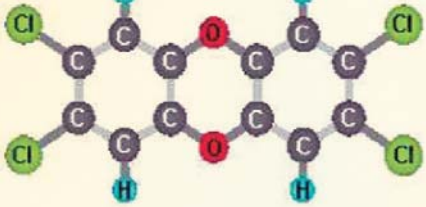
Crop	1985		2003		Increase in		
	(a)	Production (mt)		Production (mt)		Production (mt)	in Area
Fruits		150.9		184148		277880.1	
Vegetables		114.3		142559		162945.7	
Field crops		254		297160		754788.0	
Total		519.2		230280		1195613.8	

Use of the Persistent Organic Pollutants (POPs) in Oman:

There is scant official data on the use of any of the persistent organic pollutants (POPs) which are included in the Stockholm Convention. However, it is assumed that there was neither extensive use nor serious need for the application of pesticides in agriculture before the eighties. Since 1980 chlorinated hydrocarbon pesticides have been excluded from the recommendations of Ministry of Agriculture and Fisheries and substituted by organophosphorous and pyrethroid pesticides (Pesticides used in Oman, Extension Bulletin No. 26, 1983). However, in an FAO report, it was mentioned that the average of pesticides used in Oman from1980 to 1990 is 57,000 tons. Actually this figure represents the average of all pesticides which were imported to Oman in that period. More than half of those pesticides have been re-exported to neighbouring countries.

3 PCDD/PCDF, hexachlorobenzene, PCBs





However, personal communications revealed the following:

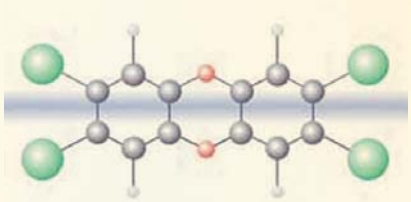
- endrin, aldrin and BHC (synonym=hexachlorocyclohexane) had been used on a limited scale before 1977. Most of the use was by spraying on nursery soils for the control of grass hoppers. It has been used also by farmers to control pests around houses.
- bidrin was used for the control of certain insects on vegetables and field crops. This was mentioned in the Annual Report of Agricultural Research (Plant Protection Section, 1976 - 1977).
- no evidence was found on the use of other POPs pesticides that are included in the Stockholm Convention in Oman.

Present use of POPs Pesticides

In the mean time the threats of pests and diseases to plants started to be more pronounced. Therefore, crop protection measures, including pesticide application, was considered necessary. Table 9 shows the pesticides used in Oman, which were recommended and subsidized by the MOA in 1983 (Pesticides used in Oman, Ministry of Agriculture, Extension Bulletin no.26, 1983).

Table 9. Pesticides used in Oman which were recommended and subsidized by the (MOA) in 1983

Pesticide type	Trade name	Common name
Insecticides	Permasect 25% EC	permethrin
	Primor 50% WP	primicarb
	Thuricide HP 16000 i.u. WP	b t
	Gardona 24% EC	tetrachlor phenefos
	Dimethoate 40% EC	dimethoate
	Diptrex 80% WP	trichlorphon
	Diazinon 5% G	diazinon
	Dimecron 50% L	phosphamidon
	Decis 25% EC	deltamethrin
	Sumithion 50% EC	phenetrithion
	Cimbush 10% EC	cypermethrin
	Furdan 5% G	carbufuran
	Kafil 10% EC	permethrin
	Croniton 50% EC	athiopheccarp
	Nogos 50% EC	dichlorovos
Fungicides	Cupper oxychloride 50% WP	cupper oxychloride
	Antracol 70% WP	propineb
	Perenox 50% WP	cupper oxide
	Tecto 40%	thiabendazole
	Dithane M 45 80% WP	mancozeb
	Sulphur WP	sulphur
	Milcurb super 25 %	athirmol
Acaricides	Omite 20% EC	perpargit
	Torque 50% WP	dialiphos
	Mitac 20% EC	amitraz





Nematicides	Nemacur 10% EC	phenamiphos
Herbicides	Gramoxon 20% L	paraquate
Rodenticide	Zinc Phosphide	zinc phosphide
Additives	Protein hydrolyzate	protein hydrolyzate
	Mineral oil	mineral oil

None of these pesticides are included in Stockholm Convention List of Chemicals.

Obsolete stocks of POPs pesticides

A questionnaire had been distributed by the Pesticides Task team to pesticides dealers. Their response was negative regarding the availability or use of obsolete stocks of POPs pesticides. From the records of MECA and MOA, Government officials responsible for issuing permits for pesticides did not find any use of POPs pesticides in Oman, hence the conclusion that no obsolete stocks exist.

Contaminated Sites

No sites contaminated with POPs pesticides have been found. Since there are no records about extensive use of POPs pesticides in the past, it is assumed, that there are no POPs pesticides contaminated sites in Oman.

POPs pesticides Monitored Data

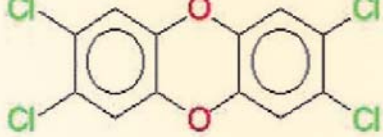
In Oman there are no monitored data on POPs pesticides or their residues either in humans, food chain or the environment because their monitoring was not considered necessary, since they were never extensively used in Oman.

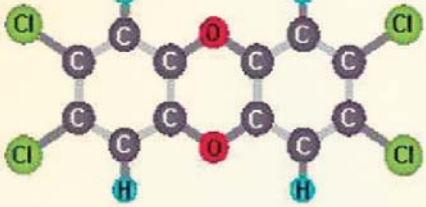
From the Indian Ocean Regional Report it was found that in India, Pakistan, Sri Lanka, Nepal, Bhutan, Bangladesh, Myanmar and 6 countries of the Gulf Cooperation Council (GCC) countries Persistent Toxic Substances (PTS) pesticides such as, aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, HCB toxaphene, mirex are either banned or not registered, since POPs are considered to be part of PTS, therefore, the presence of POPs pesticides in the environment may be due to excessive use in these countries in the past. These findings are in accordance with the conclusions of the Indian Ocean Regional Report (Regionally Based Assessment of Persistent Toxic Substances (RBA), December 2002, pg 20.). Though there is no detailed information on the past uses of POPs pesticides, it is considered that there is probably no major risk due to past uses of POPs pesticides.

Priority problems

The following priority problems of POPs management with regard to POPs pesticides were identified:

- Lack of studies on environmental & health impact assessment due to past use of pesticides
- Misleading labelling
- Lack of data on chemical residues in imported and local food
- No detailed information on the past uses and disposal of POPs pesticides
- Pesticide smuggling
- Lack of community awareness of POPs use in the past and possible impacts





2.3.2 Poly chlorinated Biphenyls (PCBs)

Introduction

PCBs are a group of hydrocarbons used either as dielectric fluid in power installations especially transformers and capacitors, or as lubricants for hydraulic equipment and plasticizers in industries. Although they played a significant role in the 20th century industrial progress, it soon became known that leaks from PCBs containing equipment, emissions from burnt transformers and industrial waste discharge presented serious health and environmental hazards due largely to their propensity for bioaccumulation and non degradability, and in the face of mounting evidence to this threat, it became obvious that the use of PCBs in the energy sector and in industrial applications had to be discontinued. Accordingly, most nations banned the production and marketing of equipment containing PCBs beginning from the 1970s.

Relevant Stockholm Convention Requirements

Polychlorinated biphenyls (PCBs) are subject to the separate Part II of Annex A in the convention text, where following obligations are stipulated:

Each party:

(a) With regard to the elimination of the use of polychlorinated biphenyls in equipment (e.g. transformers, capacitors, or other receptacles containing liquid stocks) by 2025, subject to review by the Conference of the Parties, take action in accordance with the following priorities:
   (i) Make determined efforts to identify, label and remove from use equipment containing greater than 10 per cent polychlorinated biphenyls and volumes greater than 5 liters;
   (ii) Make determined efforts to identify, label, and remove from use equipment containing greater than 0.05 per cents polychlorinated biphenyls and volumes greater than 5 liters;
   (iii) Endeavor to identify and remove from use equipment containing greater than 0.005 per cent polychlorinated biphenyls and volumes greater than 0.05 liters;

(b) Consistent with the priorities in subparagraph (a) promote the following measures to reduce exposures and risk to control the use of polychlorinated biphenyls:
   (i) Use only in intact and non-leaking equipment and only in areas where the risk from environmental release can be minimized or quickly remedied;
   (ii) Not use in equipment in areas associated with the production or processing of food or feed;
   (iii) When used in populated areas, including schools and hospitals, all reasonable measures to protect from electrical failure which could result in a fire, and regular inspection of equipment for leaks;

(c) Notwithstanding paragraph 2 of Article 3, ensure that equipment containing polychlorinated biphenyls, as described in subparagraph (a), shall not be exported or imported except for the purpose of environmentally sound waste management;

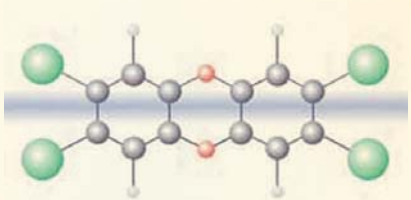
(d) Except for maintenance and servicing operations, not allow recovery for the purpose of reuse in other equipment of liquids with polychlorinated biphenyls content above 0.005 per cent;

(e) Make determined efforts designed to lead to environmentally sound waste management of liquids containing polychlorinated biphenyls and equipment contaminated with polychlorinated biphenyls having a polychlorinated biphenyls content above 0.005 per cent in accordance with paragraph 1 of Article 6 as soon as possible but not later than 2028, subject to review by the Conference of the Parties;

(f) In lieu of note (ii) in Part I of this Annex, endeavor to identify other articles containing more than 0.005 per cent polychlorinated biphenyls (e.g. cable-sheets, cured caulk and painted objects) and manage them in accordance with paragraph 1 of Article 6;

(g) Provide report every five years on progress in eliminating polychlorinated biphenyls and submit it to the Conference of the Parties pursuant to Article 15;

(h) The reports described in subparagraph (g) shall, as appropriate, be considered by the Conference of the Parties in its reviews relating to polychlorinated biphenyls. The Conference of the Parties shall review progress towards elimination of polychlorinated biphenyls at five years intervals or other period, as appropriate, taking into account such reports.





Annex A requires all Parties to cease production of new PCBs immediately (i.e., entry into force)
All Parties using the (Part II) PCB specific exemption shall:

- eliminate use of in-place equipment containing PCBs by 2025:
  - (i) make determined efforts to identify, label and remove from use equipment containing greater than 10 per cent polychlorinated biphenyls and volumes greater than 5 litres;
  - (ii) make determined efforts to identify, label and remove from use equipment containing greater than 0.05 per cent polychlorinated biphenyls and volumes greater than 5 litres;
  - (iii) endeavour to identify and remove from use equipment containing greater than 0.005 percent polychlorinated biphenyls and volumes greater than 0.05 litres;
- promote measures to reduce exposures and risk:
  - use PCBs only in intact and non-leaking equipment and only in areas where risk of environmental release can be minimized and quickly remedied
  - forbid use in food and feed production and processing areas
  - when used in populated areas (schools, hospitals, etc.)
    - take all reasonable measures to protect from electrical failure which could result in a fire
    - inspect regularly for leaks in equipment
- not export or import PCB equipment, except for the purpose of environmentally sound management (ESM) of waste
- not recover liquids with more than 0.005% PCBs for reuse in other equipment, except for maintenance and servicing
- make determined efforts to achieve ESM of wastes containing >0.005% PCBs as soon as possible, and by 2028
- endeavor to identify articles with >0.005% PCB for ESM
- report to the COP every five years on their progress in eliminating PCBs [per Article 15]

COP will review progress toward the 2025 and 2028 targets at 5 year intervals, taking into account reports from Parties

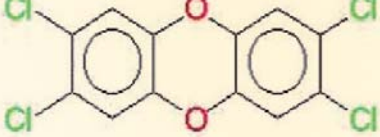
The Situation in Oman

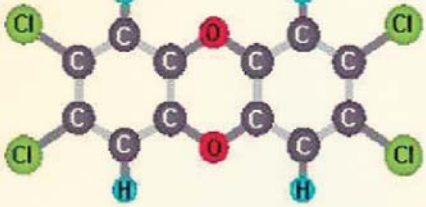
In the Sultanate of Oman, the power sector is a vital pillar supporting the fast pace of development, especially in the industrial sector. The majority of transformers in the Sultanate have been under the control of government establishments, in particular MHEW and MOD. A number of industries such as PDO, Oman Cement Company, Oman Refinery and Oman Mining Company also operate their own transformers. Recently, however, in order to position this sector to help realize the nation's development aspirations, the government decided to establish government companies to take the responsibility of production, transmission and distribution of electrical power in the Sultanate of Oman on a commercial basis, as a primary step towards the full privatization of the entire sector at a later stage. All these companies are expected to work under the umbrella of a Holding Government Company which will monitor and supervise their accounts prior to privatization.

Under the new arrangement power generation will be undertaken by Ghubrah (542 MW), Rusail (686MW), Wadi Al Jizzi (300 MW) power stations and three private power stations; Barka Power Station (427 MW), Manah Power Station (265 MW) and Al Kamil Power Station (285 MW). In 2006 the first phase of a new power station (360MW) was established in Sohar.

Power transmission is under the control of Oman Electricity Transmission Company (OETC), which is responsible for two basic activities; management of high voltage power transmission systems, and the dispatching of network loads according to technical, economic and contractual criteria.

The distribution aspect is to be controlled by three companies: Muscat Electricity Distribution Company,





Mazoon Electricity Company [for South Batinah, Dakhliah and Sharqiya areas] and Majan Electricity Company [covering North Batinah and Dhahirah areas] Two additional companies, Dhofar Electricity Company (covering the Southern power network) and the Rural Areas Electricity Company (concerned with the rural areas not connected to the national grid such as the islands and isolated villages in Al Wusta Area and Musandam) are also involved in power distribution.

As stated in the chapter on country profile, in Oman the electricity sector has the most significant bearing on the potential to release POPs into the environment, especially with transformers and other hardware whose dielectric fluid are made with or contaminated by PCBs.
In order to evaluate the extent to which PCBs exist in the Sultanate of Oman, an assessment of PCBs containing equipment, mainly transformers and capacitors, as well as wastes was undertaken.

The first step of the process entailed the collection of basic details of transformers operated by the different Organizations in the Sultanate. Such details included the holder or operator of transformers, the year of manufacture and the mode (production, transmission or distribution). These data were then compiled in a national data base prior to the test for PCBs. The data base was meant to focus on the following areas:

- Setting of the inventory form for the final inventory
- Aggregating details of transformers and their holders
- Setting of risk assessment and phasing out program
- Tracking of the PCBs equipment in use
- Monitoring temporary storage and disposal

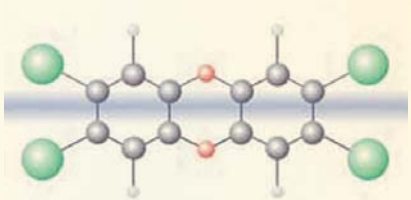
The inventory showed that there were 18,639 units of transformers in the entire Sultanate. The greater majority of these (17,853) were owned by MHEW while MOD operated 710. The rest belonged to industrial establishments mentioned earlier. Most of the transformers (17,710) were used for power distribution while 143 were involved in transmission, with the remaining 80 used for electric power production. It was also observed that the greater percentage of the transformers (10,059) was manufactured after 1990 when the use of PCBs was banned in Oman. Those manufactured before 1990 were 6,768. It was not possible to determine the year of manufacture of 1,810 transformers. From the entire population of transformers, 143 were randomly selected for testing, which largely involved testing of oil in the transformers using the CLOR-N-OIL 50 screening test. The test also included an analysis of the manufacturers' description of transformer design such as density ratio. The assessment showed that:

- There were no pure PCB oil transformers, as no positive density tests were established, a situation which might have been affected by the fact that most transformers were imported after 1990, the year PCBs were banned. Although 254 transformers were labelled with density ratio higher than 0.35 (the benchmark for assumption of PCB), it could not be conclusively determined whether they were filled with PCB oil or merely retro-filled with mineral oil until a proper density test was carried out.
- However the CLOR-N-OIL test showed that 37 (26%) of the 143 transformers tested were PCB contaminated and it was suspected that the contamination came from maintenance operations
- Relative to capacitors, Most of the types used in power networks are sealed and PCBs free according to the brand label, a claim that was considered possible as most capacitors were installed after 1990. Moreover, since the capacitor is a closed system and cannot be opened, contamination with PCB when the capacitor is "in use" is not possible.

For these reasons, capacitors were left out of the test.

Relative to site contamination, there are four main areas that are considered to be contaminated sites: workshops, warehouses, leaking transformers, (the preliminary inventory did not identify the leaking transformers) and burnt transformers.

Currently, there are three workshops for repairing transformers: one belongs to the Muscat Distribution





Electricity Company (previously MHEW) and two others are run by local private companies (Voltamp and Al Jizzi) which repair transformers for power utilities and private power suppliers. In general, during maintenance, transformer covers were opened and dielectric fluids were drained. The dielectric fluids were put through purified oil transformer machines for refilling. The grounds of the workshops can be soaked with spilled dielectric fluid. As no density tests for PCBs oil had been undertaken and the degree and risk of such contamination could not be evaluated until detailed studies are concluded, it could only be concluded that workshops are suspected contaminated site. However, since workshop staff are unaware of the hazardous impacts of unsafe contact with dielectric fluids contaminated by PCBs, clean up operation is considered necessary in the near future.

The second type of suspected contaminated sites comprises warehouses storing some broken, uncovered or leaking transformers, waiting to be sold. The grounds of the warehouses are not covered by waterproof or oil-proof materials. It is also observed that some transformers have been temporarily stored at provincial electrical utility units directly under the sun or trees right next to work places.

The third type of contaminated site is the leakage of the transformer itself. No site inspection has been carried out related to leakage of transformers. All transformers out of use and in use should be inspected to check any leaking fluid in the future inventory

The final consideration of contaminated sites is the area where transformers have caught fire. There are probably a number of transformers that caught fire but there are no records about the location of such cases or on the number of units destroyed. This is because, so far, no safe and sound management procedure is in place to manage such equipment when accidents occur. It is well known that the burning of PCB transformer is a high source of release of dioxin and furan which can contaminate the soil and other environmental media.

Currently there are two manufacturers of transformers in Oman; VOLTAMPE and Al-JIZZI. These manufacturers are new in the market, and are only supplying the local market and Gulf countries. They use mineral oil as insulating liquid for transformers. However, care has to be taken to ensure that these products are not contaminated during repair or modification by use of parts from old PCB containing transformers

Storage facilities

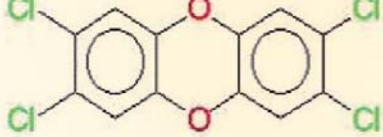
Oman does not have storage facilities for chemical hazardous wastes and other hydrocarbon wastes like used-lubricant oil. Generally, as practical, used lubricant oil is not thrown away, but instead sold for other purposes including use for secondary fuel (burning), or refining for local use.

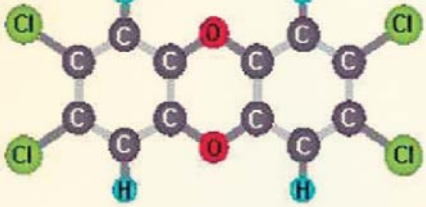
Unlike lubricant oil, dielectric fluid whether it contained PCBs or was PCB-free was discharged and then stored in metallic drums and generally kept at the workshop or warehouses. This discharged fluid was then reused as additional fluid to retro-fill other transformers after it was purified. Furthermore, if it did not meet the dielectric fluid criteria any longer (e.g. in cases where it was mixed with other substances), then such fluids would be sold for local needs/use and may be used as secondary fuel, wood treatment, lubricant for sewing machines, and other purposes.

However, even though Oman does not have waste reception facilities or storage facilities for the time being, it is necessarily to consider such facilities for the future, which are required in order to:

- Prevent further risk to public health, animals and the environment caused by PCBs-contaminated dielectric fluid spillage, mismanagement and misuse.
- Compliance with the international movement and the Stockholm Convention for the safe and sound environmental management of POPs substances.
- Further action on the disposal of and/or treatment hazard substances including PCBs and related contaminated items.

Responding to this concept, there (and especially the warehouses) should be proper storage tanks and facilities for the temporary discharge of PCB-contaminated dielectric fluid from transformers undergoing repair.





Furthermore, the Ministry Environment and Climate Affairs should provide a technical guidance to the public and private sectors on safe management, with a particular focus on the management of PCBs transformers before decommissioning. In addition, temporary or permanent storage sites should be assigned to keep PCBs and assumed PCB-contaminated transformers that are no longer used. These sites should be located away from sensitive areas including schools, hospitals, markets, residential areas, etc. and should also be equipped with fire-fighting equipment and other emergency response items.

Disposal facilities

No disposal facilities have been designed yet for PCBs substances or for other chemical hazardous wastes and wastes from hospitals. In addition, as used-lubricants and dielectric fluid still have economic value at local markets, there are existing incentives to prevent dielectric fluid from being dumped.

In conclusion, no proper place exists for PCBs dielectric fluid storage or waste reception facilities. Further consideration on the establishment of hazardous waste storage and reception facilities is underway.

The Ministry Environment and Climate Affairs should pay attention to establishing storage and/or disposal facilities to keep aged/broken transformers, PCBs dielectric fluid and other contaminated materials away from other tools and sensitive areas. This work should involve the collaboration of relevant government line ministries in order to harmonize efforts and emergency response.

The available technical options for PCB disposal in the Sultanate of Oman are:

PCB contaminated equipment

- cement kiln for the incineration of PCB contaminated mineral oil
- dechlorination of mineral oil and decontamination of solid parts with a mobile unit

PCB oil equipment: the only available option is the export of PCB waste to overseas facilities (the quantity of PCB oil equipment is relatively low to justify the investment of such specific installation or mobile unit

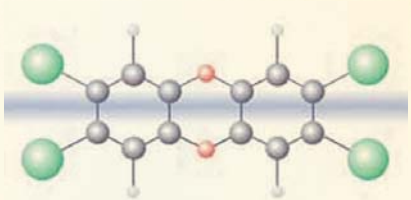
A comprehensive feasibility study should be implemented for the Best Available Technology evaluation for the Sultanate of Oman.

The MECA should consider in different manner the PCBs disposal facilities for the PCB contaminated equipment and the PCB oil equipment which require different treatment technologies

Priority problems

The following priority problems for POPs management with regard to PCBs were identified:

- No system in place for phasing out the existing PCBs containing equipment
- Incomplete transformer database (need to confirm and estimate PCBs content in the PCBs assumed transformers)
- Non existent laboratory capacity for PCBs analysis to confirm assumed PCBs
- contamination and estimate exact PCBs content
- No PCBs transformers monitoring system in place
- No management system for leaking transformers in place
- Lack of knowledge regarding PCBs problems
- No system for environmentally sound disposal of hazardous waste including PCBs
- No precaution measures taken to avoid the contamination by PCBs containing transformers
- Limited human resources in the field of awareness raising on PCBs related issues
- Weak coordination between different authorities and the public sector
- Limited public association's activities





2.3.3 DDT

Introduction

DDT is among the class of (POPs), which are organic compounds of natural or anthropogenic origin that resist photolytic, chemical and biological degradation. They are able to move long distances and are also transported in the environment resulting in wide spread distribution across the earth, including regions where they have never been used. They accumulate in fatty tissue of living organisms.

Many countries had relied on the use of DDT for the control of both Malaria and visceral leishmaniasis; until it evidence began to emerge about an association between use of DDT and the occurrence of human cancer.

Relevant Stockholm Convention Requirements

1 All Parties shall eliminate DDT production and use except Parties that notify the Secretariat of their intention to produce and/or use DDT in disease vector control programs (an "acceptable purpose" in Annex B):

these Parties will be included in a special publicly available DDT Register maintained by the Secretariat, a Party may withdraw from the DDT Register at any time

2. production and/or use must be in accordance with WHO recommendations and guidelines on use of DDT, and only when locally safe, effective and affordable alternatives are not available to the Party

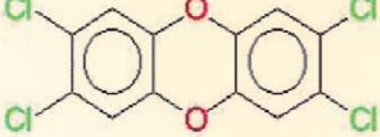
The Situation in Oman

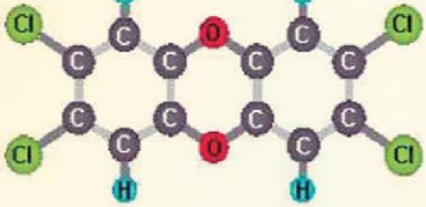
DDT has never been manufactured or formulated in the Sultanate of Oman. However, it was used in a Malaria control programme from the early seventies up to 1992.

In line with the need to obtain reliable data for the production of Oman's NIP as it relates to the requirements of the Stcockholm Convention on DDT, an inventory was done as part of the NIP elaboration process, which involved a review of all issues concerning the use of DDT in Public Health, especially vector control. The scope of the inventory included:

- The amount of DDT stock piles usable or obsolete in Oman
- The amount of DDT used for the control of malaria vector
- The amount of DDT used for the control of other vector/pests of Public health significances
- The amount of DDT used in agriculture
- The names of insect vector/pests which were susceptible to DDT
- The amount of DDT manufactured or formulated in the country
- The details of any rules and regulations against the use of DDT
- The likelihood that DDT will be used in the future

Thus all records, registries, correspondences and regulations concerning DDT management (importation, transportation, handling, storage, application and disposal) were and thoroughly studied, while All staff who dealt with DDT in the past were interviewed, and all issues related to DDT were discussed with them.
The inventory showed that within the period DDT was applied, a total quantity of 137,034 kg of DDT 75% WWP imported strictly according to WHO rules was used to spray selected villages in 28 wilayats in Oman. Some wilayats were sprayed for many years (The period of spraying ranged from a maximum of seven years in places like Shinas and Dhank, through 5 years in Mahda and Rustaq to one in other areas. (N.B. In Oman, two regions; Al-Wusta region and Dhofar governorate – are hypoendemic for malaria, thus DDT indoor spraying was never applied there)





Beginning from 1992, the use of DDT for malaria vector control was discontinued and replaced by organophosphates and synthetic pyrethroids. Due however, to an urgent need a small amount of DDT was occasionally used between 1994 and 1998 for controlling sand flies and in a few isolated cases of Leishmaniasis. In 1994, for example, only 246 kg of DDT 75% WWP was used to spray selected villages in Dhahira and Dakhliya regions, and from 1994 - 1998, a total of 143kgs of DDT 75% WWP was used for a few isolated cases of Leishmaniasis for controlling sand flies, bringing the overall quantity of DDT 75% WWP used in Oman to 137,423kgs. (Full details of information on use of DDT during the period 1976-1984 and 1985-1992 are shown in Table Nos. 8 & 9, while the graph shows data on indoor spraying from 1976-1992).

In terms of institutional structures for DDT management at the time it was used in Oman, the handling of the chemical was solely undertaken by the Directorate of Environmental Health and Malaria Eradication at the Ministry of Health under the close supervision of physicians, entomologists and epidemiologists in the Directorate. Acute symptoms and among workers and local people due to handling and application of DDT were monitored and managed by the local primary health care providers at the sites of spraying. The Royal Oman Police took all the measures to ensure safe transport of DDT. When the Directorate of Chemical Substances (MECA) was established, it strictly supervised and ensured proper management of DDT

Furthermore, there were regulations in force to ensure that:

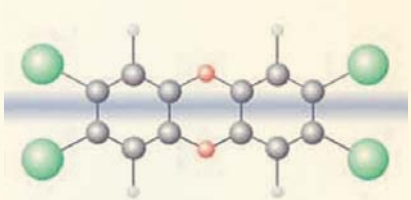
a) DDT was used only for indoor spraying.
b) DDT was transported according to the Royal Oman Police rules.
c) The necessary safety precautions were taken during DDT handling (good training of spray men, strict supervision, proper use of personal protective devices, keeping all the local people away from handling operations, and preventing contamination of food, water, clothes, etc.)
d) DDT should be kept in isolated, well ventilated stores.
e) All the available stock of DDT was donated to other countries in May 1998.
f) No further DDT was imported into Oman after 1998 by MOH
g) DDT was banned by Ministerial Decision 316/2001 of MECA. The Directorate of Chemical Substances implemented this Decision in accordance with the relevant provisions of Royal Decree No. 46/95.

In May 1998 the remaining stock of DDT amounting to 7,700 kg of DDT (technical) and 17,000 kg of 75% DDT (WWP) was donated to the Ministry of Health, Republic of Yemen for their malaria control programme and since then no further stock of DDT has been imported, or used for any purpose in Oman. (The donation was shipped in two containers to Yemen by "VESSEL MV. EAGLE FAITH VOY 021" on 15 May 1998)

From 1993 to 1999, Oman has used the following in in-door spraying as substitutes to DDT: Sumithion 40% WP (organophosphorous) with a total of 10,989 kg. The side effects recorded were the bad smell and discolouration of the sprayed wall.

During the years 1996, 1997, 1998, 1999, 2000, a total of 5,901 kg of ICON 10% WP (lambda-cyhalothrin-synthetic pyrethroid) was used for indoor spraying. The recorded side effects were temporary hypersensitivity of skin and upper respiratory tract especially among children.

With regard to environmental contamination, as DDT was used only for indoor spraying, it is believed that the possibility of contaminating water, food chain, soil or any other environmental media can only be minimal. As part of preliminary steps towards producing the NIP, an evaluation study of DDT residues and risk assessment of past indoor use of DDT was done in affected areas of the Sultanate. Indoor air samples were taken from 12 households in areas where DDT had been sprayed and from one non-DDT house as a control. Furthermore, ambient air samples were taken from four locations in industrial and residential areas of Muscat. The sampling also covered indoor dust samples and soil samples taken to gauge possible DDT transport from indoor to outdoor environment. The results showed that in some sites DDT residue was higher than EU standards, and






these were places where DDT was stored and used in the past. However, levels of two other OCPs (HCHs & HCBs) were lower than European levels. Using US Environmental Protection Agency (EPA) risk assessment approach to quantification of carcinogenic and non carcinogenic risks, there were no non-carcinogenic risks in all sites studied, but increased carcinogenic risks from dermal exposure were observed in one site which was used as storage for DDT. Significant potential carcinogenic risk for inhalation exposure was also detected in three locations in Rustaq, and it was recommended that reconstruction of houses in the three locations be done, with particular emphasis on cleaning up ceilings, walls and floors.

Priority problems

The following priority problems of POPs management with particular regard to DDT were identified:

Priority problems

- Lack of studies on environmental & health impact assessment due to past use of DDT
- Medical workers are not aware of the possible residual impact due to past DDT exposure
- Lack of data on chemical residues in imported and local food
- Lack of community awareness of POPs use in the past and possible impacts

2.3.4 Unintentionally Produced POPs

Introduction

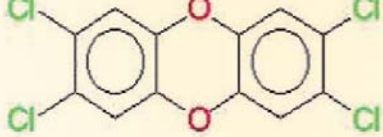
Polychlorinated-dibenzo-p-dioxins (PCDDs) and Polychlorinated-dibenzo-furans (PCDFs) commonly referred to as 'dioxins' have received significant attention in the press in recent years. Over the last number of years several countries have published dioxin emission inventories, identifying possible sources of dioxin emissions and estimating emissions for each of these sources. These estimates have been used to derive 'emission factors' for dioxins, i.e. the expected mass emission of dioxins to the environment per unit of industrial activity –e.g. grams of dioxins per tone of production. Emission factors developed by individual countries have been tentatively used to estimate emissions in other countries, where measured data may not be available, such as Oman, hence it was anticipated that such national emission factors would be used during this project to estimate dioxin emissions in Oman. However, in early 2001, the United Nations Environment Programme (UNEP) issued a draft "Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases" (UNEP Chemicals, 2001). The toolkit has been developed by UNEP to address the lack of standardization internationally with regard to national and regional inventories, and hence to facilitate the development of consistent and comparable data.

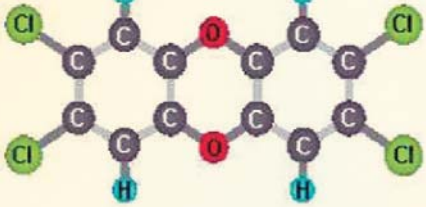
This inventory was prepared with the aid of the methodology and suggested emission factors contained in the UNEP Toolkit.

as having potential for comparatively high formation & release of POPs to environment (including

The Situation in Oman

Though the Sultanate of Oman has undergone a period of rapid development characterized by expanding oil, industrial and energy sectors, with their obvious potential for the emission of POPs, there was no previous detailed dioxin emission inventory for Oman. The inventory of polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzo furans (PCDF) emissions in the environment therefore became necessary especially within the context of the entire inventory of Persistent Organic Pollutants (POPs compounds) in the Sultanate of Oman, in accordance with preparations for the implementation of the Stockholm Convention, especially the introduction of systematic monitoring and supervision over production and use of POPs, followed by the gradual cessation of their use.





This emission inventory is therefore the first carried out in Oman and it is a preliminary inventory. It should be noted that PCDDs and PCDFs are referred to collectively through out this report as **'dioxin**s'. The standard unit of measurement for dioxins is grams/toxic equivalent (g/TEQ). Toxicity equivalency factors have been developed in dividable PCDD/PCDF congeners allowing the quantification of complex congener mixtures as a single numerical descriptor. A number of polychlorinated biphenyls (PCBs) are also reported to exhibit dioxin-like behavior. However, very little information is currently available on emission factors for dioxin-like PCBs, and consequently dioxin-like PCB emissions are not included in this inventory.

The main objectives of the study were to:

- Identify the principal sources of dioxin emissions in Oman;
- Quantify these emissions on the basis of reported information;
- Prepare an inventory of dioxin emissions for the calendar year 2002.

The methodology stipulated by UNEP Chemicals, the Standardized Toolkit for Identification and Quantification of Dioxin and Furan releases (UNEP 2003) were used in carrying out the PCDD/PCDF inventory, and the first step was to identify the sources of emissions, which are applicable to Oman from the different sources listed in the toolkit.

Table 10 shows emission sources applicable to Oman. (Note: Since dioxin emissions data were not available for the majority of the identified sources, a degree of uncertainty must be associated with the results).

Table (10) Sources of unintended POPs by-products emissions

No	Main Source Categories	Air	Water	Land	Product	Residue
1	**Waste Incineration**	X				X
2	**Ferrous and Non-Ferrous Metal Production**	X				X
3	**Power Generation and Heating**	X		X		X
4	**Production of Mineral Products**	X				X
5	**Transport**	X				X
6	**Uncontrolled Combustion Processes**	X	X	X		X
7	**Production and Use of Chemicals and Consumer Goods**	X	X		X	X
8	**Miscellaneous**	X	X	X	X	X
9	**Disposal**	X	X	X		X
10	**Identification of Potential Hot Spots**					

Table 11 shows by-product generating sources and release routes for both main and sub categories in Oman.

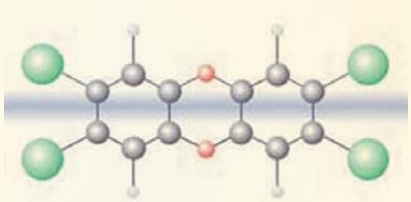
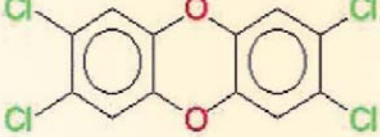
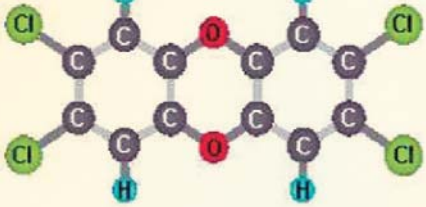




Table11: By-product Generating Sources and Release Routes in Oman

No.		Main category	subcategory
1	**Waste Incineration**		
	a		- Municipal waste incineration
	b		- Hazardous waste incineration
	c		**- Medical waste[1]**
	d		- Light fraction shredder waste
	e		- Sewage sludge incineration
	f		- Waste wood incineration
	g		- Destruction of animal carcasses
2	**Ferrous and Non-ferrous Metal Production**		
	a		**Iron ore sintering (2006 Sohar)**
	b		**Coke production (2006 Sohar)**
	c		**Iron and steel, foundries**
	d		**Copper production (Sohar Wadi Aljizzi)**
	e		**Aluminum production (2006 Sohar)**
	f		Lead production
	g		Zinc production
	h		Brass and bronze production
	i		Magnesium production
	j		Other nonferrous metals
	k		Shredders
	l		Thermal wire reclamation.
3	**Power generation and Heating/Cooking**		
	a		**Fossil fuel power plants**
	b		Biomass power plants
	c		Landfill biogas combustion
	d		**Household cooking biomass (Charcoal)**
	e		**Household cooking fossil fuel (Gas)**
4	**Production of Mineral Products**		
	a		**Cement production**
	b		Lime production
	c		Brick production
	d		**Glass production**
	e		**Ceramics production**
	f		**Asphalt mixing**
5	**Transport**		
	a		**4-Stroke engines**
	b		**2-Stroke engines**
	c		**Diesel engines**





No.		Main category	subcategory
6	**Uncontrolled Combustion Processes**		
	a		**Biomass burning (open burning to clean the fields)**
	b		**Waste burning and accidental fires**
7	**Production of chemicals and consumer goods**		
	a		Pulp and paper production
	b		Chemical industry
	c		**Petroleum industry (refineries)**
	d		**Textile production**
	e		Leather refining
8	**Miscellaneous**		
	a		Green fodder (tobacco leaves drying on sun)
	b		**Crematoria**
	c		Smoke houses
	d		**Dray Cleaning**
	e		**Tobacco Smoking**
9	**Disposal**		
	a		**Landfills**
	b		**Sewage / Sewage treatment**
	c		**Open water dumping**
	d		**Composting**
	e		Waste oil treatment (non thermal)
10	**Hotspot**		
	a		Production sites of chlorinated organics
	b		**Production sites of chlorine**
	c		Formulation sites of chlorinated Phenols
	d		Application sites of chlorinated phenols
	e		Timber manufacture and treated sites
	f		**PCB-filled Transformer**
	g		Dumping of wastes/residues from categories 1-9
	h		Sites of relevant accidents
	i		Dredging of sediments

Based on the inventory the following emerged as the most significant issues related to the unintentional release of dioxins in Oman;

Category One : Waste incineration

The incineration of waste is among the activities which contribute to the formation of PCDD/PCDF as well as compelling the need to identify and apply measures to prevent formation or minimize releases of PCDD/PCDF.

The subcategories to be evaluated under this category are indicated in Table 12

Table 12: subcategory of Main category Waste Incineration

No .		**Subcategories**	**Potential Release Route**				
			Air	**Water**	**Land**	**Product**	**Residue**
1		Waste Incineration					
	a	Municipal waste incineration	**X**				**X**
	b	Hazardous waste incineration	**X**	**(X)**			**X**
	c	**Medical waste**[2]	**X**	**(X)**			**X**
	d	Light fraction shredder waste	**X**	**(X)**			**X**
	e	Sewage sludge incineration	**X**				**X**
	f	Waste wood incineration	**X**	**(X)**			**X**
	g	Destruction of animal carcasses	**X**				**X**

At present, municipal solid waste incineration is not undertaken in Oman and there are no incinerators in the country. Instead, waste dumps are widely used. The only type of incineration which takes place in Oman relates to the disposal of medical waste.

Medical Waste Incineration:

Medical waste is defined as every waste generated from medical activities. The waste generated during these activities contain infectious materials, secretions, blood, pharmaceuticals and packaging materials and/or tools used for the medical treatment of people or animals. In order to effectively destroy any inherent viruses, bacteria, and pathogens, such waste is often thermally treated (by incineration or pyrolysis).

Furthermore, due to its origin and its composition, medical waste can contain toxic chemicals, e.g., heavy metals or precursors, which may form dioxins and furans. In many countries, medical waste requires special surveillance, and it is believed that incineration of all wastes generated within a hospital would be the most efficient way to get rid of these wastes.

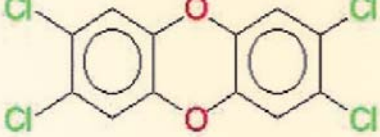
However, it has also been shown that incineration of medical waste in small and poorly controlled incinerators can be a major source of PCDD/PCDF (UNEP 1999). Consequently, medical waste is incinerated locally at a hospital or any other medical facility in small furnaces in a batch-type mode.

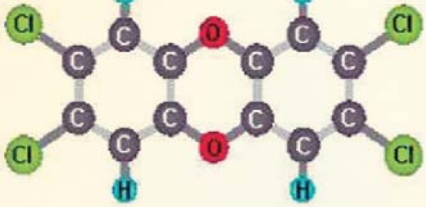
There are four classes of emission factors from medical waste incinerators as such in table 13.

Table 13: Emission factors for medical waste incineration

	Emission Factors -µg TEQ/t Medical Waste Burned	
	Air	Residue
1.Uncontrolled batch type combustion, no APC system	40,000	200 *
2.Controlled, batch type combustion, no or minimal APC	3,000	20 *
3.Controlled, batch type combustion, good	525	920 **
4.High technology, continuous, controlled combustion sophisticated APC system	1	150 **

*refers only to bottom ash left in the combustion chamber
**refers to the combined bottom and fly ashes





The Situation in the Sultanate of Oman

At the time of the inventory there were 14 fully functional medical waste incinerators in the Sultanate, all owned and operated by the Ministry of Health. These incinerators are designed for batch type combustion with minimal to zero APCS. The most modern incineration facility, which was not included in the inventory was billed to start operating in December 2005. It was established as part of the comprehensive waste treatment Plant system in Muscat Governorate under the auspices of the Ministry of Health.

The incinerator, Figure 2, consists of two parallel incinerator lines, each designed for a waste feed rate of 250kg/h, with total waste treatment capacity of 4tons/day for 8-hours of operation per day. The air pollution control system of the incinerator is designed to comply with the most recent EU standards for incinerators. It is intended to serve as a single off-site facility to treat medical waste generated from all hospitals, clinics, pathological laboratories and any other MOH healthcare facilities located within the Muscat governorate. In this new incinerator, medical waste is burnt in the air under a two-stage combustion process. In the primary combustion chamber, the moisture present in the waste is evaporated, the volatile components are vaporized and the fixed carbon is oxidized. In the secondary combustion chamber, volatile organics are completely oxidized. Incombustible inorganic matter is removed as bottom ash from the primary chamber. The combustion gasses released from the secondary chamber are first cooled down in a heat exchanger and then passed through an air pollution control system for the removal of acid gases and particulates before they are released into the atmosphere through a stack. The schematic process flow diagram of the incinerator is shown in the figure below. The ash generated will be kept in a storing area until the National Hazardous Waste Management project is ready.

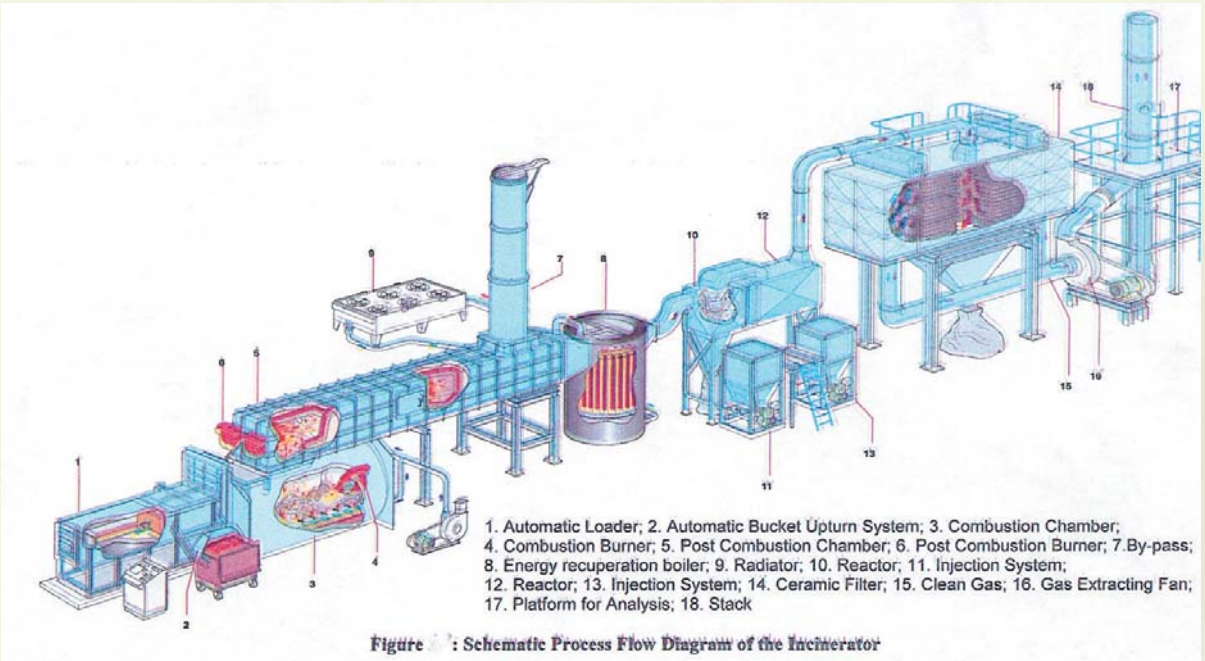


Figure 2: The most modern incineration facility in Muscat Governorate

The major generators of medical waste utilizing the incinerator facility and the quantities of waste generated by them are presented in Table14.

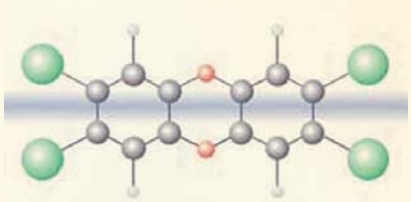


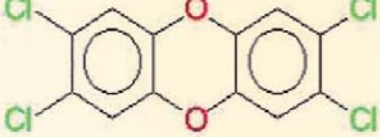



Table (14): The quantity and the producer of the waste which will be treated by the new incinerator

Name of the MOH Healthcare Facility	Type	Approximate Quantity of Medical Waste Generated	
		Minimum (kg/day)	Maximum (kg/day)
Royal hospital in Buasher	Secondary and tertiary healthcare; 633 beds; both in patients and out-patients	850	850
Khoula Hospital in Mina AlFahal	Secondary and tertiary healthcare; 477 beds; both in patients and out-patients	750	875
Al Nahda Hospital in Ruwi	Secondary and tertiary healthcare; 114 beds; both in patients and out-patients	330	740
Buasher Polyclinic in Buasher	Consultation and primary healthcare; out patiently only	105	480
Regional Dialysis Unit in Buasher	Rental treatment only	115	190
Al Khoud Health Center	Consultation and primary healthcare; out patiently only	45	200
Mabela Health Center	Consultation and primary healthcare; out patiently only	45	160
South Mabela Health Center	Consultation and primary healthcare; out patiently only	45	160
Al Amerat Health Center	Consultation and primary healthcare; out patiently only	45	160
Al Ghubra Health Center	Consultation and primary healthcare; out patiently only	45	160
Wattaya Health Center	Consultation and primary healthcare; out patiently only	45	160
Al Nahda Health Center	Consultation and primary healthcare; out patiently only	90	160
Ar Rahma Hospital in Muttrah	Consultation and primary healthcare; out patiently only	45	140
Muscat Health Center	Consultation and primary healthcare; out patiently only	45	120
Alkuwair Health Center	Consultation and primary healthcare; out patiently only	45	120
Seeb Health Center	Consultation and primary healthcare; out patiently only	45	120
Seeb New Health Center	Consultation and primary healthcare; out patiently only		110
Ibn Sina Hospital in Al Amerat	Consultation and primary healthcare; out patiently only	60	80
Wadi Kabir Polyclinic	Consultation and primary healthcare; out patiently only	15	60
Quriyat Hospital	Consultation and primary healthcare; out patiently only	15	40
Azaiba Health Center	Consultation and primary healthcare; out patiently only	15	40
Yeti Health Center	Consultation and primary healthcare; out patiently only	15	30
Seifa Health Center	Consultation and primary healthcare; out patiently only	15	30
Siya Health Center	Consultation and primary healthcare; out patiently only	10	20
Muzara Health Center	Consultation and primary healthcare; out patiently only	10	20
Bima Health Center	Consultation and primary healthcare; out patiently only	10	20
Dagmar Health Center	Consultation and primary healthcare; out patiently only	10	20
Muttrah Health Center	Consultation and primary healthcare; out patiently only	10	20
Wadi Al Aribian Health Center	Consultation and primary healthcare; out patiently only	5	10
All Healthcare Facilities within Muscat Governorate	Total Quantity of Medical Waste Generated per Day: Minimum 3.0 Tons Maximum 5.4		

The air pollution control system is designed to meet the most recent EU emissions standards for incinerators.

From the statistical data and chosen emission factors, the annual emission estimates for medical waste shown in table (15).



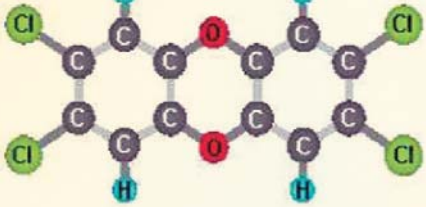


Table (15): Total Emission for medical waste incinerator

Total amount of waste incinerated (t)	Emission Factors -µg TEQ/t	Emission - g TEQ/t	
		Air	Residue
450	3000	1.335	0.01

Ferrous and Non-Ferrous Metal Production

The iron and steel industry as well as the non-ferrous metal industry are highly material and energy intensive industries. A considerable proportion of the mass inputs become outputs in the form of off-gases and residues. The most relevant emissions are those to air. Furthermore, secondary materials and the rate of recycling and reuse of solid residues constitute a large part of the industrial activities. Ores and concentrates contain quantities of metals other than the prime target metal and processes are designed to obtain a pure target metal and to recover other valuable metals as well. These other metals tend to concentrate in the residues from the process, and in turn, these residues form the raw material for other metal recovery processes.

Lastly, filter dusts can be recycled within the same plant or used for the recovery of other metals at other non-ferrous metal installations, by a third party or for other applications.

This category is divided into several categories as listed in the table below:

Table (16):Subcategories of Main Category 2 – Ferrous and Non-Ferrous Metal Production

No .		Main Categories and Subcategories	Potential release Route				
			Air	Water	Land	Product	Residue
2		**Ferrous and Non-Ferrous Metal Production**					
	a	Iron ore sintering	X				X
	b	Coke production	X	X	X	X	X
	c	Iron and steel, foundries	X				X
	d	Copper production	X				X
	e	Aluminum production	X				X
	f	Lead production	X				X
	g	Zinc production	X				X
	h	Brass and bronze production	X				X
	i	Magnesium production	X	X			X
	j	Other nonferrous metals	X	X			X
	k	Shredders	X				X
	l	Thermal wire reclamation	X	(X)	X		X

Table 17 shows the classes of emission factors which will be used for this category.

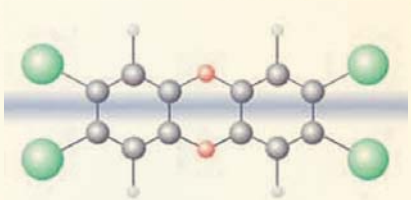




Table (17):Emission factors for the steel industry and iron foundries

Classification	Emission Factors –µg TEQ/t of LS				
	Air	***Water***	***Land***	***Product***	***Residue***
Iron and Steel making					
1.Dirty scrap (cutting oils, general contamination), scrap preheating, limited controls	10	ND	NA	NA	15
2.Clean scrap/virgin iron, after burner and fabric filter	3	ND	NA	NA	15
3.Clean scrap/virgin iron, EAF designed for low PCDD/PCDF emission, BOF furnaces	0.1	ND	NA	NA	1.5
4.Blast furnaces with APC	0.01	ND	ND	ND	ND
Iron Foundries					
1.Cold air cupola or rotary drum with no gas cleaning	10	NA	NA	NA	ND
2.Rotary Drum -fabric filter	4.3	NA	NA	NA	0.2
3.Cold air cupola –fabric filter	1	NA	NA	NA	8
4.Hot air cupola, or induction furnace –fabric filter (foundry)	0.03	NA	NA	NA	0.5

The Situation in the Sultanate of Oman

Iron ore sintering

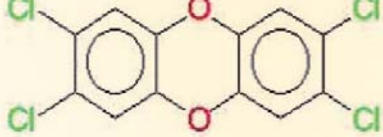
At present, this activity is not being carried out in the Sultanate, but it is expected to start in the year 2006 with the production of 1,500,000 tons/year at Sohar Industrial State. It is designed to process Iron oxide (lump Ore or Pellets) by using natural gas to produce Hot Direct Reduced Iron (HDRI). The project uses MIDREX technology which is well known internationally as an environmentally clean technology due to the use of natural gas, minimum emission discharge, reuse of all waste in the processes and equipment with high technology to capture and control any emission to the environment.

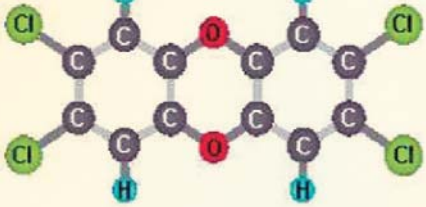
a. Iron and steel foundries

Two factories were identified, which were engaged in iron foundries with total production of about 150 ton/year. From the small amount of production the total contribution to the total emissions is not significant. One of the factories uses induction furnace and the other uses the electric AVC furnace. The temperature range in both furnaces is between 1600 to 1650 ˚C. The emission factors used is number 4, which is for hot air cupola, or induction furnace –fabric filter (foundry) and therefore the emission will be as follows:

Table (18):Total emission for Iron and steel, foundries

Quantity of iron processed (t/year)	Emission Factors –µg TEQ/t		Emission g TEQ/t	
	Air	***Residue***	***Air***	***Residue***
150	0.03	0.50	0.0000045	0.000075





b. Copper production

The information which is available is about primary copper. There is no information about secondary copper. Emission factor for copper production are shown in the table below:

Table 19: Emission factors for the copper industry

Classification	Emission Factors –µg TEQ/t of Copper				
	Air	Water	Land	Product	Residue
1.Sec.Cu -Basic technology	800	ND	NA	NA	630
2.Sec.Cu -Well controlled	50	ND	NA	NA	630
3.Sec.Cu -Optimized for PCDD/PCDF control	5	ND	NA	NA	300
4.Smelting and casting of Cu/Cu alloys	0.03	ND	NA	NA	ND
5.Prim.Cu including thermal steps	0.01	ND	NA	NA	ND

The Situation in the Sultanate of Oman

The only category which is applicable to the Sultanate at the time of the inventory is the extraction of primary copper. There is only one factory extracting copper in Oman and the total quantity processes for the year 2002 is 24000 tons.

In order to estimate the total emission from this sector, primary copper emissions factors were used as indicated in Table 19. Thus the total emission from this sector is shown in Table 20.

Table 20: Total Emission for copper production:

Quantity of copper produced (t/year)	Emission Factors –µg TEQ/t	Emission g TEQ/t
	Air	***Air***
24000	0.01	0.00024

c. Aluminum production

Production of primary Aluminum is not carried out in the national environment at the time of this inventory but this activity is expected to start in Sohar in the year 2006. The Sohar Aluminum Project consists of an aluminum smelter with associated infrastructure and a production capacity estimated at an initial capacity of 630 000 tones of aluminum per year.

The technology to be used for the electrolysis of alumina to produce aluminum was developed by Pechiney France. This technology known as AP-30 is one of the world's most modern and effective with a high production of aluminum per unit of power.

Secondary aluminum is obtained by re-melting Aluminum scrap, shavings, and other materials containing aluminum. Secondary aluminum production can be performed in a variety of furnaces and this is carried out in the Sultanate in small-scale workshops.

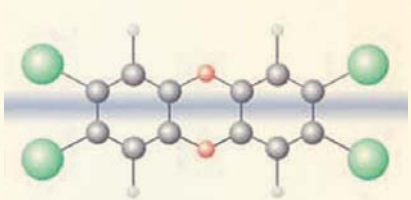




Table21*:* Emission factors for the aluminum industry

Classification	Emission Factors –µg TEQ/t of Aluminum				
	Air	Water	Land	Product	Residue
1.Thermal processing of scrap Al, minimal treatment of inputs and simple dust removal	150	ND	NA	NA	400
2.Thermal Al processing, scrap pre-treatment, good controls, filters with lime injection	35	ND	NA	NA	400
3.Shavings/turning drying	5	ND	NA	NA	NA
4.Thermal Al processing, scrap pre-treatment, well-control, fabric filters with lime injection	3.5	ND	NA	NA	100
5.Optimized for PCDD/PCDF control –afterburners, lime injection, fabric filters and active carbon	0.5	ND	NA	NA	100

The total quantity of secondary aluminum processed in small-scale workshops in 2002is about 100 tons. Most of the production processes take place without APCS. Because of this the first emission factor in Table 21 is the one which is used for this sector. And therefore the total emission for Iron and Steel is given in Table 22.

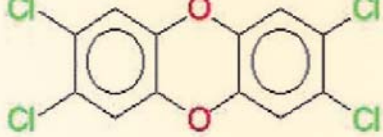
Table 22: Total Emission for Iron and steel, foundries

Quantity of Aluminum processed (t/year)	Emission Factors –µg TEQ/t		Emission g TEQ/t	
	Air	***Residue***	***Air***	***Residue***
100	150	400	0.015	0.04

Category 3: Power Generation and Heating

The category of power generation and heating includes power stations, industrial firing places (furnaces) and installations for providing space heating, which are fired with fossil fuels (including the co-combustion of up to 1/3 of waste), biogas including land fill gas, and bio mass only. In Oman the source of power generation is limited to natural gas and diesel (fossil fuel power plants) the sub categories of main source category 3 are shown in table 23, and table 24 shows emission factor for fossil fuel based power generation. Light fuel and natural gas are always fired in specially designed burners and are not likely to generate large amounts of PCDD/PCDF since both are very high calorific, clean burning fuels with little to no ash. It is only when liquid or sludge waste is co-fired that higher concentrations of PCDD/PCDDF are likely to be formed.

As in all combustion processes, PCDD/PCDF are usually formed after the combustion process is completed and the flue gas cools down. The remaining organic fragments and the chlorine contained in the coal recombine in the presence of the metal-chloride catalysts to form PCDD/PCDF. Releases to water, land and products are normally negligible. Thus, the only important release routes are through air and residue, especially fly ash.



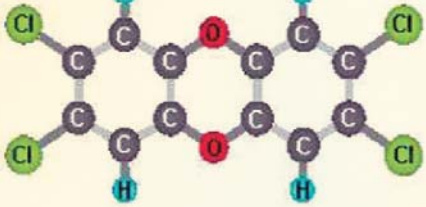


Table 23: Subcategories of Main Source Category 3 –Power Generation and heating/cooking

No .		Subcategories	*Potential release Route*				
			Air	***Water***	***Land***	**Product**	***Residue***
3		**Power generation and Heating/Cooking**	**X**		**(X)**		**X**
	a	Fossil fuel power plants	X				**X**
	b	Biomass power plants	**X**				X
	c	Landfill biogas combustion	X				**X**
	d	Household cooking biomass (Charcoal)	**X**		**(X)**		X
	e	Household cooking fossil fuel (Gas)	X		**(X)**		**X**

Table 24: Emission factors for fossil fuel-based power generation and production of heat/energy in industry

Classification	Emission Factors -µg TEQ/TJ of Fossil Fuel Burned		
	Air	Water	Residue
1.Fossil fuel/waste co-fired power boilers	35	ND	ND
2.Coal fired power boilers	10	ND	14
3.Heavy fuel fired power boilers	2.5	ND	ND
4.Light fuel oil/natural gas fired power boilers	0.5	ND	ND

The caloric values of the different fuels utilized for the generation of electric power were: Fuel: 41,31 MJ/Kg.; Diesel:(Gas oil): 44,99 MJ/Kg.-Crude oil: 40,55 MJ/Kg. – Fuel extrapesado: 40,96 MJ/Kg.; Gas natural: 45,62 MJ/Kg and Coal: 34,69 MJ/Kg. From all of these the total emissions from the power sector is calculated as follows:

Table 25: Total Emission for power generation

Type of fuel utilized	Consumption of fuel (t/a)	Equivalent energy (TJ)	Emission Factors - in Air (µg TEQ/TJ)	Emission in Air (µg TEQ/TJ)
Diesel	7308	328.8	0.5	0.0001644
Natural Gas	3483500	158917.27	0.5	0.08
Subtotal		159246.07		0.0801644

Category 4: Production of Mineral Products

This section summarizes high-temperature processes in the mineral industry. Raw materials or fuels that contain chlorides may have the potential to cause the formation of PCDD/PCDF at various steps of the processes, e.g., during the cooling phase of the gases, at pre-heaters or in the heat zone. Due to the long residence time in kilns and the high temperatures needed to fabricate the product, emissions of PCDD/PCDF are generally low in these processes as shown in table 26.

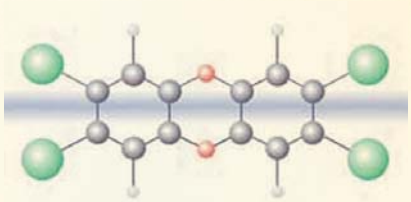




Table 26: Subcategories of Main Category 4 –Production of Mineral Products

No .		Subcategories of Main Category	Potential release Route				
			Air	Water	Land	Product	Residue
4		**Production of Mineral Products**	**X**				**X**
	a	Cement production	X				**X**
	b	Lime production	**X**				X
	c	Brick production	X				**X**
	d	Glass production	**X**				X
	e	Ceramics production	X				**X**
	f	Asphalt mixing	X			X	X

The results of the inventories for the production of mineral products:

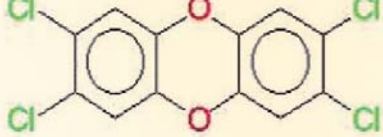
a. Cement Production

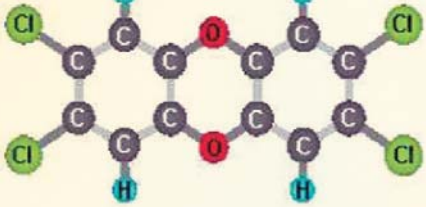
Principal raw materials used in the cement manufacturing industry are clay and limestone. Cement manufacture begins with calcinations, which is the decomposition of calcium carbonate (CaCO3) at about 900 °C to leave calcium oxide (CaO, lime) and carbon dioxide (CO 2). Afterwards, lime reacts at temperatures typically around 1,400-1,500 °C with silica, alumina, and ferrous oxide to form silicates, aluminates, and ferrites of calcium (clinker). The clinker is then ground or milled together with gypsum (CaSO4) and other additives to produce cement.

There are four main process routes for the manufacture of cement: the dry, semi-dry, semi-wet and wet processes. In the dry process, the raw materials are ground and dried to raw meal, which is fed to the pre-heater or pre-calciner kiln (or more rarely into a long dry kiln). The dry process requires less energy than the wet process. The majority of the European kilns use the dry process. In the wet process, the raw materials (very often with high moisture content) are ground in water to form a pumpable slurry, which is fed directly into the kiln or first into a slurry dryer. Most of the U.S. cement kilns use the wet process.

The process: the raw materials are first brought to site, then mixed, crushed and ground to produce a raw meal of the correct particle size and chemical properties. The raw meal is converted into cement clinker by preprocessing in rotary kilns (50 m in length and more than 5 m in diameter). These consist of a refractory lined cylindrical steel shell slightly inclined to the horizontal and rotating at 1–3 rpm. Raw material is fed in at the upper end and gradually moves downward towards the lower end where a burner provides counter-current heating. The rotary kilns in the cement manufacture are different from the classic firing processes as feed materials and off-gases pass each other counter-currently thus leading to a thoroughly mixing, high temperatures (>1,400 °C at the hot end where clinker is formed),and long residence times (5-7 s)of the gases. These conditions will result in the destruction of any organic contaminants introduced with the fuel at the primary burner.

Modern cement kilns often use the dry process, in which raw mill material may be pre-heated in a vertically arrayed multi-cyclone pre-heater, in which the rising hot gases exiting the kiln contact the downward flowing raw materials. Some dry processes also employ a pre-calciner stage beneath the pre-heater, just before the raw material enters the kiln. The use of the wet process, where the ground meal is mixed with water and fed into the kiln as slurry uses about 40 %more energy than the dry process.





The last stage involves cooling the clinker. As the hot clinker comes off the end of the lower end of the kiln it is rapidly cooled by ambient air in a clinker cooler, *e.g.* a traveling grate with under-grate fans that blow cool air through the clinker (EMEP 1999).
Finally, the cooled clinker is mixed with gypsum and, for composite cements, other materials such as blast furnace slag, are ground to a fine homogeneous powder to produce the final product, which is then stored in silos prior to bulk transportation or bagging.
Typical fuels used are coal, oil, and gas or petroleum coke. In many cases a variety of waste fuels are also used to supplement the fossil fuel. The wastes used may include: waste oils, solvents, certain industrial wastes, and in some cases hazardous wastes.

In the USA tests have indicated that higher emissions were found for some kilns where hazardous wastes were fired (EPA 1998).More detailed investigation has suggested that, provided combustion is good, the main controlling factor is the temperature of the dust collection device in the gas cleaning system, the plants equipped with low temperature electrostatic precipitators appear to have well controlled emissions with or without waste fuels.

Kilns usually have a device to reduce emissions of particulate matter and to capture particles, which may be valuable as cement product. The pollution control system may be a simple dust collector (cyclone), electrostatic precipitators or fabric filters. In some plants other pollution controls may be fitted such as gas scrubbers. The following classes of emission factors were developed as shown in table 27.

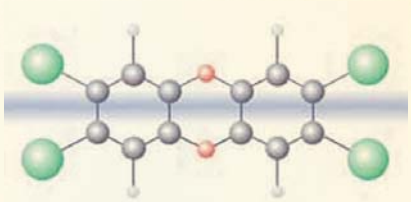
Table 27: Emission factors for cement production

Classification	Emission Factors -µg TEQ/t of Cement				
	Air	Water	Land	Product	Residue
1. Wet kilns, ESP temperature >300 °C	5.0	ND	ND	ND	1.0
2. Wet kilns, ESP/FF temperature 200-300 °C	0.6	ND	NA	ND	0.1
3. Wet kilns, ESP/FF temperature <200 °C Dry kilns with APC (all types)	0.05	ND	NA	ND	0.003

In Oman there are two Cement factories with total production of 1.9 million ton/year. Both factories are classified as Wet kilns, ESP/FF temperature 200-300 °C and therefore the total emission will be as shown in table 28.

Table 28: Emission for cement production

Quantity of Cement produced	Emission Factors -µg TEQ/t of Cement		Emission g TEQ/t of Cement	
	Air	Residue	Air	Residue
1.9 million ton	0.6	0.1	1.14	0.19






b. Lime production

This activity is not carried out in the national environment

c. Brick production

This activity is not carried out in the national environment

d. Glass production

Furnaces used for glass manufacture may be continuously or intermittently operated. Typical fuels used in the process are oil and gas. The raw materials are principally sand, limestone, dolomite and soda. In addition, a wide range of other materials may be used to achieve desired properties such as color, clarity, and for purification. Chlorinated and fluorinated compounds may be added (SCEP 1994).

In some modern glass furnaces gases are cleaned with sorbents and electrostatic precipitators or fabric filters.

Very few tests are available and they are mainly from Germany where pollution control is usually very good. It is possible that where standards of pollution control are weaker emissions could be higher. A lack of control over the fuels used, cleaning of recycled glass or pollution controls applied could all result in much higher emissions.

The following classes of emission factors were selected:

Table 29: Emission factors for glass production

Classification	Emission Factors -µg TEQ/t of Product				
	Air	Water	Land	Product	Residue
1. Cyclone /no dust control	0.2	NA	ND	ND	ND
2. Glass production using dust abatement	0.015	NA	ND	ND	ND

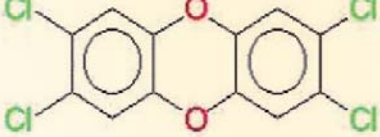
There is only one glass factory in Oman with total production of 50000 tons/year. Since the factory uses the dust abatement system, the total emissions shown in table 30.

Table 30 :Emission for glass production

Quantity of glass produced	Emission Factors -µg TEQ/t of Cement	Emission g TEQ/t of Cement
	Air	Air
50000 tons	0.015	0.00075

e. Ceramics production

There is not sufficient information to consider the production of ceramics as a source of PCDD/PCDF. However, it is likely that because it is a thermal process, PCDD/PCDF can be released to air. It is proposed that an estimate be made by the application of the emission factors developed for brick making as shown in the following table



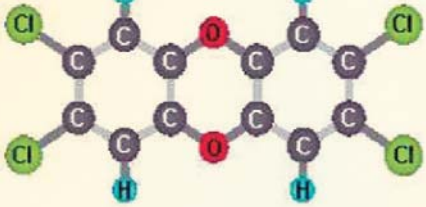


Table 31:Emission factors for brick (ceramics) production

Classification	Emission Factors -µg TEQ/t of Product				
	Air	Water	Land	Product	Residue
1. Cyclone /no dust control	0.2	NA	NA	ND	ND
2. Ceramics production using dust abatement	0.02	NA	NA	ND	ND

There are two ceramics factories in Oman. One of them has no dust control and produces 5000 tons/year. The other has a dust control system, and produces 120,000 tons /year. From the above details, the total emissions are shown in table 32.

Table 32: Emission factors for Ceramics production

Quantity of Ceramics produced	Emission Factors -µg TEQ/t of Cement	Emission g TEQ/t of Cement
	Air	Air
5000 tons	0.2	0.001
120000	0.02	0.0024

f. Asphalt mixing

Asphalt is used for road construction and generally would consist of rock chips, sand, and fillers bound together in bitumen. Fillers can include fly ash from incineration or power plants.

The first stage of the process is an air-drying unit for the minerals. The hot minerals are then mixed with hot bitumen to obtain asphalt.

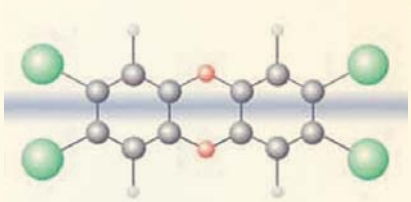
Asphalt mixing plants in industrialized countries may typically have gas cleaning facilities consisting of fabric filters or wet dust control devices.

The following classes of emission factors were developed for this activity:

Table 33: Emission factors for asphalt mixing

Classification	Emission Factors -µg TEQ/t of Asphalt				
	Air	Water	Land	Product	Residue
1. Mixing plant with no gas cleaning	0.07	NA	ND	ND	ND
2. Mixing plant with fabric filter or wet scrubber	0.007	NA	ND	ND	0.06

There are several companies, which produce asphalt in Oman. They have mixing plants which have no devices






for gas cleaning. Their production capacities and emission rates are shown in table 34.

Table 34: Emission for asphalt mixing

Quantity of Asphalt produced	Emission Factors -µg TEQ/t of Asphalt		Emission g TEQ/t of Asphalt	
	Air	Residue	Air	Residue
120000 tons	0.007	0.06	0.00084	0.0072

Category 5: Transport

This category can be divided into the following subcategories which is shown in table 35.

Table 35: Subcategories of main categories 5 : Transport

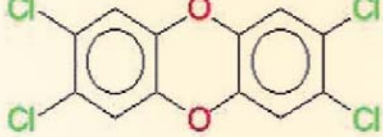
No .		**Subcategories of Main Category**	Potential release Route				
			Air	Water	***Land***	***Product***	***Residue***
5		Transport	**X**				**X**
	a	4-Stroke engines	X				**X**
	b	2-Stroke engines	**X**				X
	c	Diesel engines	X				**(X)**
	d	Heavy oil fired engines	**X**				(X)

a. 4-stroke engines

Most gasoline powered internal combustion engines used today in cars; light trucks, motorcycles and other vehicles are 4-stroke engines. These engines follow the thermodynamic combustion cycle invented by Nicolaus Otto, which consists of 4 strokes, namely the intake stroke, the compression stroke, the ignition and combustion stroke, and the exhaust stroke.

These four strokes are completed during two full revolutions of the crankshaft. Like all combustion processes, internal combustion engines produce PCDD/PCDF as an unwanted byproduct. Higher emissions have been associated with the use of chlorinated scavengers used in leaded gasoline. However, when unleaded gasoline is used and a catalytic converter is installed f or the removal of NO x as well as unburned hydrocarbons, the emissions of PCDD/PCDF are negligible. The only release vector is into the air.

All other release vectors are not present. Thus, for the following categories default emission factors were established and it is shown in Table 36:



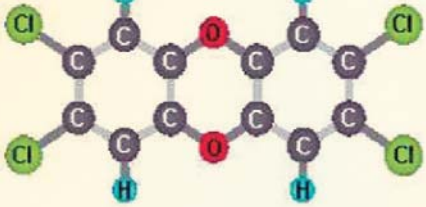


Table 36 :Emission factors for 4-stroke engines (i.e. passenger cars)

Classification	Emission Factors -µg TEQ/t Fuel Burned				
	Air	Water	Land	Product	Residue
1. Leaded fuel[14]	2.2	NA	NA	NA	NA
2. Unleaded fuel without catalyst[14]	0.1	NA	NA	NA	NA
3. Unleaded fuel with catalyst[14]	0	NA	NA	NA	NA

Since almost all cars in Oman have catalytic converters and the fuel is unleaded, the emission for this subcategory is considered negligible.

b. 2-Stroke engines

Most small gasoline powered internal combustion engines used in boats, jet-skis, mopeds, small motorcycles, tuk-tuks, lawnmowers, chain saws, and other vehicles are 2-stroke engines. These engines follow the same thermodynamic combustion cycle as the 4-stroke engines. However, it consists of only 2 strokes, namely the combined exhaust and intake stroke, and the compression, ignition and combustion stroke. The most striking difference from the 4-stroke engine is the fact that all strokes occur during only 1 full revolution of the crankshaft. Lubrication is usually by oil added with the fuel. Therefore, higher amounts of pollutants may be released and efficiency may be lower compared to 4-stroke engines. However, the simplicity and low production cost of 2-stroke engines make it an ideal motor especially for small engines. Like all combustion processes, 2-stroke engines also produce PCDD/PCDF as an unwanted byproduct. The only release vector is into the air. All other release vectors are not present. Thus, for the following categories default emission factors were established as shown in Table 37.

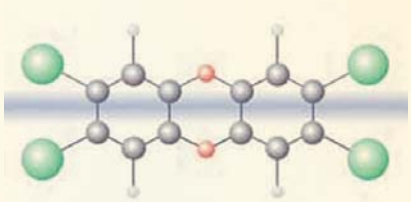
Table 37: Emission factors for 2-stroke engines (i.e. small mopeds)

Classification	Emission Factors -µg TEQ/t of Fuel Burned				
	Air	Water	Land	Product	Residue
1. Leaded fuel[14]	3.5	NA	NA	NA	NA
2. Unleaded fuel without catalyst[14]	2.5	NA	NA	NA	NA

There are no exact data about the quantity of fuel used for this subcategory in the Sultanate.

c. Diesel engines

Diesel engines are used in heavy trucks, light trucks, passenger cars, heavy construction equipment, boats, Diesel generators, pumps, and farm equipment including tractors and other large equipment. They usually use Diesel (light oil) and a 4-stroke cycle. Compression is used for ignition rather than a spark. Air is taken into the cylinder and compressed. Diesel fuel is added at high pressure and burned. This results also in a more efficient use of fuel and lower specific emissions. Unfortunately, particle emissions in the form of soot are also associated with the operation of Diesel engines due to incomplete combustion especially during start-up, warming and load changes. Deposition of this soot can lead to releases *via* residues.





Particulate emissions from Diesel engines are well known to contain high concentrations of polycyclic aromatic hydrocarbons (PAH). How ever, there are no PCDD/PCDF concentrations in Diesel soot. There is only one class of emission factor for Diesel engines.

There are no exact data about the quantity of fuel used for this subcategory in the Sultanate.

Table 38: Emission factors for diesel engines (i.e. trucks)

Classification	Emission Factors -µg TEQ/t of Fuel Burned				
	Air	Water	Land	Product	Residue
1. Diesel engines 15	0.1	NA	NA	NA	ND

d. Heavy oil fired engines

Heavy fuel oil (HFO) fired engines are used for ships, tanks, stationary power generators, and other very large quasi-stationary motors. The availability of emission factors is very limited and presently no distinction can be made with respect to composition of the fuels with respect to *e.g.,* chlorine content, type of catalytic metals present, etc. Based on very limited data, only one default emission factor to air was determined.

Waste oils are of ten burned in motors (stationary or in ships); they will be included in this subcategory.

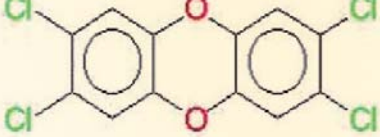
There is no information that this kind of fuel is used in Oman.

Table 39: Emission factors for heavy fuel and waste oil fired engines (i.e. ships)

Classification	Emission Factors -µg TEQ/t of Fuel Burned				
	Air	Water	Land	Product	Residue
1. All Types	4	NA	NA	NA	ND

Category 6: Uncontrolled Combustion Processes

Uncontrolled combustion processes considered in this section include the burning of harvest residues, trees or bushes in the open air where no incinerator, stove or boiler is used. This category also includes the informal "disposal" of waste in barrels or in the open-air as well as landfill fires, or accidental fires in buildings, vehicles, *etc.* In general, none of these combustion processes and fires is controlled, resulting in poor combustion conditions due to inhomogeneous and poorly mixed fuel materials, chlorinated precursors, humidity, or catalytically active metals. This category is shown in the following table.



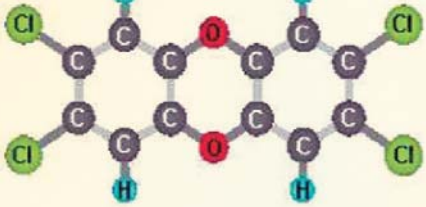


Table 40: Subcategories of Main Category 6 –Uncontrolled Combustion Processes

No		**Subcategories of Main Category**	Potential release Route				
			Air	Water	Land	Product	Residue
6		**Uncontrolled Combustion Processes**	**X**				**X**
	a	Biomass burning	X	(X)	X		**(X)**
	b	Waste burning and accidental fires	**X**	**(X)**	**X**		(X)

a. Biomass Burning

This category covers the burning of biomass in the open (*i.e.* excluding controlled combustion in appliances such as stoves, furnaces and boiler plants). This sub-category includes forest fires (deliberate and accidental) as well as burning of grassland or harvest residues such as straw, in the field. Post-harvest field burning is a common practice to remove residues, control weeds, and release nutrients for the next crop cycle.
The emission factors are:

Table 41:Emission factors for biomass burning

Classification	Emission Factors -µg TEQ/t of Material Burned				
	Air	Water	Land	Product	Residue
1. Forest fires	5	ND	4	NA	NA
2. Grassland and moor fires	5	ND	4	NA	NA
3. Agricultural residue burning (in the field), not impacted	0.5	ND	10	NA	NA
4. Agricultural residue burning (in the field), impacted, poor conditions	30	ND	10	NA	NA

Emission factors are expressed per ton of material burned. In this subcategory the emission factor is given for "Land" since due to the lack of containment, the ashes are deposited on land and typically are not collected for further disposal. Within this sub-category the hardest step may be to estimate the quantity of material burned in any of these classes.
The information about this category in Oman is limited and the only statistics available relates to the number of fires (369 in 2002).

b. Waste burning and accidental fires

This is a broad and poorly quantified sector. It includes the deliberate combustion of waste materials for disposal where no furnace or similar equipment is used –for example the burning of domestic and other waste in piles in the open, the burning of waste in land fills - both deliberate or accidental - fires in buildings, cars and similar vehicles. It includes the following categories:

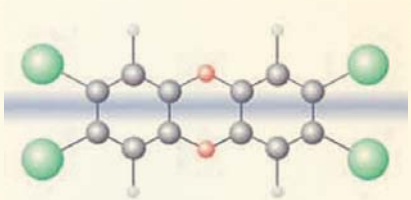




Table 42:Emission factors for waste burning and accidental fires

Classification	Emission Factors -µg TEQ/t of Material Burned				
	Air	*Water*	*Land*	*Product*	*Residue*
1. Landfill fires	1000	ND	NA	NA	ND
2. Accidental fires in houses, factories	400	ND	See residues	NA	400
3. Uncontrolled domestic waste burning	300	ND	See residues	NA	600
4. Accidental fires in vehicles	94 (per vehicle)	ND	10	NA	18(per vehicle)
5. Open burning of wood (construction/demolition)	60	ND	ND	NA	10

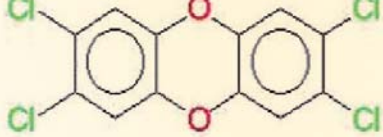
Uncontrolled domestic waste burning should include all instances where waste is burned with no pollution controls and therefore includes burning in the open in piles, in barrels or in home fires. The burning of waste in landfills is considered a separate category. An estimate of the amount of PCDD/PCDF remaining in solid residues can be derived for this practice and is expressed in terms of PCDD/PCDF per unit of waste burned.
Accidental fires are very variable and the emissions will depend strongly on the materials burned and on the nature of the fire. There is limited information on emissions from these fires and a single indicative figure is given to cover all accidental fires excluding fires in vehicles. PCDD/PCDF will be present in residues that may be disposed of or left on the ground.

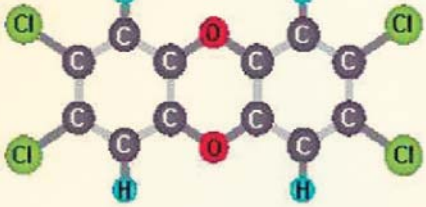
Chemical fires may lead to very high releases where certain precursor chemicals are involved. However, there is insufficient information to assess releases from chemical fires as a distinct category, and releases are included in the subcategory of accidental fires. It should be noted that specific incidences could give rise to local pollution and a potential “hot spot”.

Vehicle fires can release PCDD/PCDF, but limited data are available to give emission factors for such events. The vehicles involved can vary considerably and emissions are expected to vary. Thus figures here are for initial estimates only.
In some countries a considerable amount of wood used in construction and demolition is burned for disposal. There are no exact data on the quantity of any kind of the above categories; the only exception being vehicles. Since they are per vehicle, the total emission will be:

Table 43: emission of burned vehicles

Number of vehicle burned	Emission Factors –µg TEQ/vehicle		Emission g TEQ/t	
	Air	*Residue*	*Air*	*Residue*
292	94	18	0.0274	0.0053





Category 7: Production and Use of Chemicals and Consumer Goods

There are five main sub categories in this category, namely;

Table 44: Subcategories of Main Category 7 –Production and Use of Chemicals and Consumer Goods

No .		**Subcategories of Main Category**	***Potential release Route***				
			Air	***Water***	***Land***	***Product***	***Residue***
7		Production and Use of Chemicals and Consumer Goods	X	X		X	X
	a	Pulp and paper production	X	X	(X)	X	**(X)**
	b	Chemical industry (chlorophenols, halogenated organics,Cl2 production, oxychlorination processes)	**X**				X
	c	Petroleum industry (refineries)	X				X
	d	Textile production		X		X	
	e	Leather refining		X		X	

a. Pulp and paper production
This activity is not carried out in the national environment.

b. Chemical industry (chlorophenols, halogenated organics,Cl_2 production, oxychlorination processes)
This activity is not carried out in the national environment.

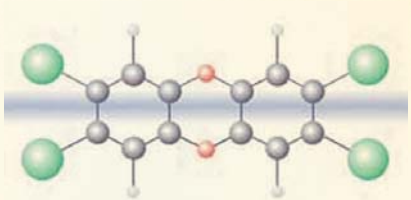
c. Petroleum industry (refineries)

Crude oil is a mixture of different hydrocarbons and small amounts of impurities. The composition of crude oil can vary significantly depending on its source. Petroleum refineries are a complex system of multiple operations and the operations used at a given refinery depend upon the properties of the crude oil to be refined and the desired products. Within the petroleum refining industry, so far, only one potential source for PCDD/PCDF has been reported: re-generation of the catalyst used during catalytic cracking of the larger hydrocarbon molecules into smaller, lighter molecules ***(Beard et al.1993).***

Feedstock to catalytic reforming processes is usually low octane naphtha. Catalytic hydro reforming uses platinum-based catalysts. In the continuous process, aged catalyst is continuously removed from the bottom of the reactor and sent to a regenerator where the carbon is burned from the catalyst with hot air/steam. Trace quantities of a promoter, normally organochlorines, such as trior perchloroethylene, are added to retain catalytic activity. Moisture is removed and the regenerated catalyst is returned to the first reformer bed. In the cyclic or semi-regenerative units, the regeneration of the catalyst is discontinuous as well as the resulting emissions. In this process, PCDD/PCDF have been detected. PCDD/PCDF may be emitted to air or captured in scrubbing systems and transferred to effluents. Ultimate releases will depend on the pollution controls and handling of residues. No emission factors can be given at this time due to lack of data.

d. Textile production
This activity is not carried out in the national environment.

e. Leather refining
This activity is not carried out in the national environment.





Category 8: Miscellaneous

This category comprises eight processes that could not be classified in the other Main Source Categories. The subcategories are shown in the following table:

Table 45: subcategories of main category 8: Miscellaneous

No .		**Subcategories of Main Category**	***Potential release Route***				
			Air	***Water***	***Land***	***Product***	***Residue***
8		**Miscellaneous**	X	X	X	X	X
	a	Drying of biomass (green fodder, wood chips)	X			X	
	b	Crematoria	**X**				X
	c	Smoke Houses	X			X	X
	d	Dry cleaning residues		X		X	X
	e	Tobacco smoking	X				

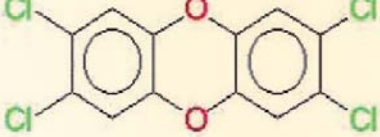
a. Drying of biomass (green fodder, wood chips)
   This activity is not carried out in the national environment.
b. Crematoria

Cremation is a common practice in many societies where dead bodies are disposed of by burning. The essential components for cremation are the charging of the coffin (and the corpse), the main combustion chamber, and where applicable the afterburning chamber. In some cases, a dust separator or more sophisticated gas treatment is present. Finally, gases leave through the stack. Most furnaces are fired using natural oil or natural gas; some run on electricity. Crematoria are usually located within cities and close to residential areas and normally, stacks are relatively low. Both facts result in relatively immediate impacts on facilities, the environment and humans Emission factors for Cremation are shown in the following table.

Table 46:Emission factors for crematoria

Classification	Emission Factors -µg TEQ/t of per Cremation				
	Air	Water	Land	Product	Residue
1. No control	90	NA	NA	NA	ND
2. Medium control	10	NA	NA	NA	2.5
3. Optimal control	0.4	NA	NA	NA	2.5

There is only one crematorium in Oman and it is with no control. The total emission for it is shown below:



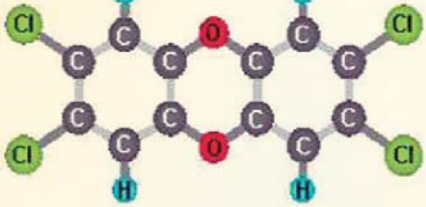


Table 47: Emissions from crematoria

No. of bodies	Emission Factors -µg TEQ/t of per Cremation	Emission g TEQ/t of per Cremation
	Air	Air
24	90	0.0022

c. Smoke Houses
This activity is not carried out in the national environment

d. Dry cleaning residues
Although there is dry-cleaning facilities, there is no information available about the residues.

e. Tobacco smoking
As any other thermal process, combustion of cigarettes and cigars produces PCDD/PCDF.

Table 48: Emission factors of cigarettes burning

Classification	Emission Factors –pg I-TEQ/Cigar or Cigarette				
	Air	*Water*	*Land*	*Product*	*Residue*
1. Cigar	0.3	NA	NA	NA	ND
2. Cigarette	0.1	NA	NA	NA	2.5

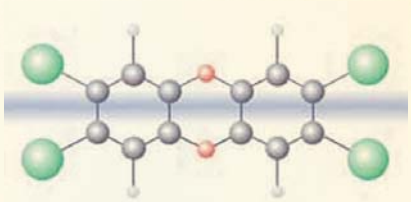
Cigars and cigarettes are not produced in the country but they are imported and smoked.

Table 49: Emission factors from cigarettes burning

Classification	Quantity	Emission Factors –pg I-TEQ/Cigar or Cigarette	Emission µg TEQ/Cigar or Cigarette
		Air	Air
1. Cigar	13728	0.3	0.004
2. Cigarette	27456513	0.1	27.46

Priority Problems and objectives

1. Lack of proper waste management, in particular prevention of uncontrolled burning of dumping sites
2. Improper hospital waste incineration
3. Insufficient enforcement of the BAT requirements as stated in RD 114/2001
4. Low hazard awareness of people who are living close to burning damping sites and medical waste incinerators
5. Significant gaps in the level of education among the local authorities' officials
6. The influence of cultural background of general public in respecting of the safety measures
7. Insufficient knowledge about POPs by –products releases prevention and/or control possibilities (BEP/BAT) at the management level





8. Lack of training for the technical staff
9. Back yard burning of waste

Objectives

- Improve the current waste management practice
- Capacity building among local officials on BAT and BEP
- Ensure that BAT and BEP is applied for medial waste incineration
- Ensure enforcement of the regulation prohibiting backyard burning of waste
- Ensure proper enforcement of the BAT requirements
- Provide training for the technical staff on BAT and BEP
- Provide sufficient knowledge on POPs by-product at the management level
- Raise the level of awareness among public
- Raise awareness about the safety measures for the general public

2.3.5 Summary of future Production, Use and Releases of POPs – Requirements for Exemptions

The rapid pace of modernization and industrialization in Oman has been mentioned in previous parts of this document. It was however stressed that the underlying philosophy of development in the Sultanate is the sustainable use of natural resources, a core value that is embodied in the national umbrella Act governing the prevention of pollution. Therefore, Oman is keen to ensure that present and future commercial and industrial enterprises minimize or avoid the generation of POPs emissions, and for these purposes, the Sultanate of Oman has no requirements for exemptions on the use and releases of POPs under the Stockholm Convention and is not likely to require such exemptions in the future.

2.3.6 Awareness and Information

Introduction

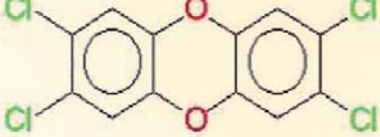
For the successful implementation of the national plans and strategies relating to the Stockholm Convention on POPs, it is of extreme importance that all stakeholders, be they policy and decision makers, technical and managerial staff, entrepreneurs, industrial workers, educators, students, consumers or the general public are not only availed of comprehensible and relevant information on POPs issues and their health and environmental effects, but also encouraged to participate in programmes and plans aimed at addressing such issues. Though the processes culminating in the production of the NIP are themselves contributory to the raising of awareness among certain cadres such as policy makers and technical staff in government and private organizations involved in the NIP production, there is a great need for educating the general public on the issues relating to POPs and what roles they are expected to play to deal with them in accordance with the NIP

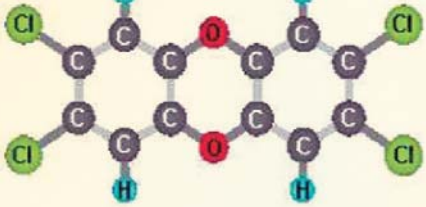
Relevant Stockholm Convention Requirements

Article 10 Public information:
Parties shall, within their capabilities:

- ensure public has access to up-to-date information [para. 2]
- encourage industry and professional users to promote and facilitate provision of information at national & other levels [para. 3]

  Parties may:
- use range of approaches to provide information, and may establish information centers at national & regional levels [para. 4]
- develop mechanisms (such as Pollution Release and Transfer Register) to collect and disseminate information on annual amounts of POPs in Annex A, B or C that are released or disposed of [para.5]





The Situation in Oman

As part of the preliminary exercises towards the NIP elaboration, a series of assessments of the general awareness and perception of POPs and POPs related issues was carried out. One such assessment was done among the following main target groups:

Government officials

Municipal authorities

General public

Another assessment of awareness of the hazards of POPs with particular focus on POPs pesticides, PCBs, DDT, by-products, and wastes was aimed at:

0 Experts in the relevant fields
1 Management of enterprises concerned with such substances
2 Potentially exposed employees / workers
3 Potentially exposed members of the general public

With regard to general awareness and perception of POPs and POPs related issues, it was found that there was a considerable level of awareness of POPs pesticides including DDT, and POPs by-products among all target groups, especially government staff who were directly involved with drafting and enforcing implementation of regulations regarding these substances. However, awareness of more complex issues such as PCBs is very low among government officials, municipal authorities and the general public. However, since the inception of the project, the level of awareness among government officials, especially technical staff involved in the project has risen considerably. In order to acquaint the public with information about various POPs issues, MECA has organized lectures, seminars and presentations in schools and universities. It has also commissioned the publication of the bare facts in plain English and Arabic for public enlightenment. Plans are also being made to inculcate POPs issues into educational broadcasts for schools and the general Public.

In terms of knowledge of POPs hazards, PCBs once again turned out to be one of the dark horses. Due largely to the non availability of PCB experts both in government and private establishments, workers in the field did not seem to possess adequate knowledge about the sound management of PCBs and the risks involved in improper management.

Neither general education nor the professional education system in Oman integrates subjects related to health issues affected by PCBS. This results in no one understanding about the risks of PCBs substance that affect human health, animals and the environment.
Furthermore, there is also a lack of understanding by decision makers, government officers, and electrical utility workers about PCBs and the way they can affect human health and the environment, as no educational curriculum has been designed to address this.

The general public has also no knowledge/awareness on issues related to the impact of PCBs on human health and the environment. This is because Oman has no expertise on PCBs and related hazards. However, some governmental officials have just begun to learn about and gain awareness on the PCBs issue when NIP project started. In addition, through some training workshops with the assistance of international experts, PCBs awareness raising has improved to some extent. Some governmental officers from the Ministry of Environment and Climate Affairs, Ministry of Commerce and Industry, Ministry Oil and Gas staff and municipality electricity utilities have received some training on PCBs.

Knowledge of PCBs hazards is generally low among management of the enterprises concerned with PCBs management. Furthermore, at the management level, both government and private sectors have not done anything regarding the preparation of PCBs management regulation, health protection regulation, PCBs hazard

training programs, and awareness raising on guidelines for PCBs safe use. However, several decision makers of the concerned enterprises have now been trained under support from NIP project.

Although some government officials and managers of the concerned enterprises have been trained, the exposed employees and workers have not. The exposed employees and workers who work in transformer workshops, warehouses, and power plants are unaware of PCBs hazard.

A lack of awareness by the public regarding PCBs hazards is extremely dangerous. Many cases have been identified where the public have purchased PCB oil from transformer maintenance workshops to polish wooden furniture and to treat wooden materials.

In general, the exposed general public has not been provided with any education on such matters. Indeed, very limited information has been disseminated for public awareness. Hazards and perceptions of PCBs have been promoted through the mass media for public understanding and raising awareness only during the preparation phase of the NIP. Other than this, the mass media have shed no light on this issue as they too have no knowledge about PCBs.

Some problems related to public awareness on PCBs can be identified as follows:

- Technical training on PCBs perception and hazards has not yet become widely available;
- Education programs for exposed employees and workers is inadequate;
- Comprehensive PCBs training through mass media is still not available;
- Supporting programs for the promotion of public awareness on PCBs are not available;
- National as well as international mechanisms for information exchange and technological transfer are limited; and
- Data records and database management systems on PCBs issues are absent

To improve the current situation, the appropriate measures must be taken in order to increase public awareness of the PCB problem. These measures have to be applied to the different target groups, such as the public, schools, industry, importers, waste producers, recyclers, dismantlers, etc.

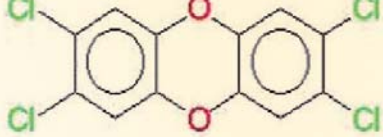
Another aspect of POPs that had yet to fully grasped by the major target groups is the dangers of unintentional release of POPs by-products. There is very limited knowledge about mechanisms of creation of the unintentionally produced POPs by-products (dioxins and furans) as well as about possibilities to prevent and /or reduce these releases.

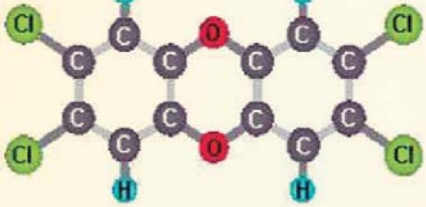
Specific training for experts in this field is necessary to enable them to understand how POPs by products are unintentionally produced, and about their potential hazards for human health and environment. Investigations are also necessary about possibilities to replace older industrial technologies, with high potential for unintentional POPs by products releases, with cleaner technologies, complying with BAT&BEP.

The concerned enterprises (waste incineration plants) are informed about the specific legislation regarding POPs by-products (air emission standard for dioxins & furans (0.5 ng/m^3). However, implementation of this standard is limited.

There is a lack of awareness of the proper management of the open damping sites, especially health impacts of exposition of both workers and residents open burning of waste. The public is usually offended by the bad smell and the black smoke emitted from burning of waste, but has limited awareness of the ensuing health hazards.

As in mere perception of POPs issues, awareness of the hazards of POP s pesticides, including DDT was high among experts in the relevant fields..





Priority problems and objectives of raising Awareness, and disseminating Information on POPS

The following priority problems were identified as impingements on POPs management with regard to awareness raising and information dissemination.

- Limited resources allocated for awareness programs on unintentionally produced POPs releases and their reduction
- Lack of technical and scientific knowledge about PCBs
- Information about direct health impact on public is limited
- Insufficient awareness about POPs by-products releases prevention and/or control possibilities (BEP/BAT) at the management level
- Improper management of landfill sites (open burning)
- No awareness of the public about the risk of the back yard burning of waste
- Limited human resources in the field of awareness raising
- Weak coordination between different authorities and the public
- Limited public association's activities
- Significant gaps in the level of education among the local authorities officials
- Lack of health risk assessment study due to past indoor uses of DDT
- General public and previously exposed workers are not aware of the possible residual impact due to DDT exposure

Objectives

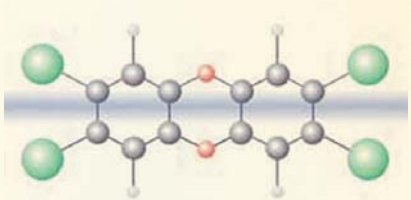
- Implement long term awareness raising campaign on POPs
- Capacity building of specialists on technical and scientific knowledge about POPs
- Provide training about the proper management of landfill sites on the management level
- Raise awareness about hazards connected with backyard burning
- Involve more technical human resources in the POPs awareness raising campaign
- Activate the public association (NGOs)
- Raise awareness on POPs on the decision maker's level

MECA as the National focal point for the NIP, coordinates information exchange with other parties to the Convention

2.3.7 Monitoring

Introduction:

Considering the importance of monitoring the situation of POPs to the successful implementation of Oman's NIP, the Chemicals Department of MECA has a Monitoring and Assessment Section that conducts regular inspection of relevant sites as well as monitors activities related to the use of chemicals in various manufacturing and production sectors. The Section samples locally made and imported products to determine their compliance with both national and international regulations on chemicals, especially the Stockholm Convention. The Section also works in close collaboration with other departments and sections in the Ministry such as the Consumer Affairs Section of the Directorate-general of Health Affairs and Waste Water, which monitors the safety of cosmetics, canned food and other consumer products. Other collaborators with whom MECA carries out its monitoring activities include the Ministry of Agriculture, which is currently working with the Food and Environment Centre of MECA in a project to detect chemical residues in locally grown and imported vegetables, crops and fruit.





Relevant Stockholm Convention Requirements

Parties must, within their capabilities, address the following obligations in preparing their action plans to address research, development and monitoring measures (Article 11):

- At the national and international levels, encourage and/or undertake research, development, monitoring and cooperation on all aspects of POPs, their alternatives and candidate POPs, including on (para. 1):
    - Sources and releases into environment;
    - Presence, levels and trends in humans and the environment;
    - Environnemental transport, fate and transformation;
    - Effects on human health and the environment;
    - Socio-economic and cultural impacts;
    - Release reduction and/or elimination; and
    - Harmonized methods for making source inventories and analytical techniques for measuring releases.
- In undertaking the actions in paragraph 1 (para. 2)
    1. Support and further develop international programmes, networks and organizations to define, conduct, assess and finance research, data collection and monitoring;

The Situation in Oman

Although PCBs-contaminated dielectric fluid can be identified and found to exist in Oman, the monitoring program/activities for safe and sound environmental management of PCBs related materials and equipment have not yet been designed.

There are also no regulations or guidelines on the management of such PCBs as well as restricted access to where PCBs transformers have been installed or have caught on fire.
All people and animals can be freely and easily access places where dielectric fluid has spilled, leaked and/or been discharged.

The major potentially exposed population is the workers and employees who are working at the workshops, warehouses, and power plants. They may be critically affected by PCBs due to a lack of personal protective equipment and awareness. The people who are dealing with the used-oil contaminated by PCBs may face the negative impacts from PCBs and those who are living surrounding the contaminated areas are also assumed that they may be affected by PCBs.

It is hard to assess the impact on the environment and human health as there is no country data on the possible impacts of PCBs. In addition, there is no available medical facility for assessing the impacts of PCBs on human health for the time being. Furthermore, there is also no method or facilities for assessing the impact of PCBs on the environment.

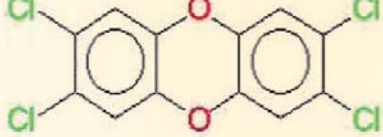
To overcome the present situation, it is important to consider future need to conduct research on these points (environmental and biological samplings). In doing so, Oman will have the opportunity to prevent further impacts that may be caused by PCBs and contaminated equipment.

PCBs monitoring data

The PCB monitoring data concerns different media:

- the electrical equipment in use or out of use
- the used oil after decommissioning the transformer
- the different matrix in ecosystems
- food
- the human

Table 50 indicates monitoring data for different media.



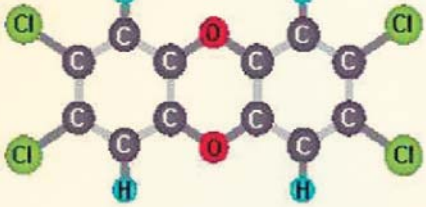


Table 50 Monitoring and action requirements in the Sutltanate

Matrix or media	Situation in Oman	Action, requirements
Electrical equipment in use or out of use	No monitoring data except for dielectric properties of transformer oil before regeneration	Inventory of all the transformers PCB Testing of dielectric on site and in the workshop
Contaminated sites	No monitoring of contaminated sites	Sampling and testing of soil
The different matrices in ecosystems	- water table and sea water: no - sludge and sediment : no - live organisms - soil	Sampling and testing by GC for every matrix or organism
Food (milk product, meat, fishes)	no	Sampling for each type of food which are able to bio accumulate the PCB
Human tisues	- blood - milk of mothers	Sample for workers in electrical companies Sample selected population with different criteria (age, women, babies)

2.3.8 - Overview of technical infrastructure for PCBs assessment, measurement, analysis, management, research and development – linkage to international programs and projects

In Oman, there are several laboratories available, which belong to governmental institutions and they work for specific parameters and purposes. The following provides information on these laboratories:

- Laboratory of the Ministry of Commerce and Industry, works on analyzing industrial chemicals substances that will be used for producing goods and items and then checks to verify standard limits in the industrial products;
- Laboratory of the Ministry of Commerce works on controlling and verifying chemicals limits in all kinds of goods that are trafficked and marketed throughout the country and for import and export purposes;
- Laboratory of the Ministry of Agriculture, works on analyzing chemical fertilizers and pesticides;
- Laboratory of the Ministry of Environment and Climate Affairs works on analyzing pollutant substances in various environmental media;
- Laboratory of the Ministry of Health has the capacity to analyze chemical substances in drug and cosmetic products; and
- Other laboratories.

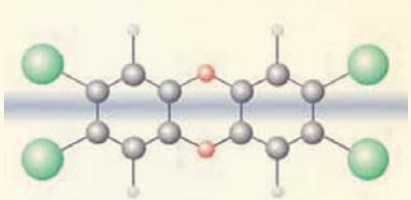
Nevertheless, none of these laboratories target analyze of PCBs substance whether it is contained in the products or in waste forms. Facilities for PCBs analysis are not yet available in Oman.

Overview of technical infrastructure for POPs pesticides monitoring, analysis, management, research and development

Technical infrastructure for POPs pesticides Analysis

Monitoring and Analysis

In the Chemical Substances Department, the Monitoring and Assessment section is responsible for monitoring the chemicals transported, handled and used throughout the country. Pesticides are included in this system. This section consists of:





Head of section
Three inspectors

There is also the Food and Environment Central Laboratory which belongs to the MRMWR. This laboratory has the following responsibilities:

- Analysis of different food products, environmental media and several industrial raw materials and products.
- Determination of quality control standards and also executing projects and research for continuous monitoring for the safety of food and environment

It is equipped with highly sophisticated state-of-the art equipment and instruments, and highly trained technicians, graduates and experts.

The laboratory consists of different sections, according to its laboratory activities:
Environmental and Food Chemistry Section

A. Organic Pollutants Analysis Unit:

- Analysis of pesticides, fungicides, herbicides i.e. organic chlorine pesticides, organophosphorus pesticides, carbonate pesticides and pyrethroid pesticides.
- Analysis of PCB content in environmental samples and in potentially polluted with this compound i.e. fish, meat and diet products.
- Detection of Aliphatic and polynuclear aromatic hydrocarbons.
- Determination of hydrocarbons, oils and grease in air, water, soil and marine precipitate.
- Estimation of volatile compounds and semi volatile compounds in different water sources.
- Making projects and researches on monitoring of organic pollutants in different environmental media and food.

B. Heavy Metal Analyses Unit

Detection of heavy metals i.e. Fe, Mn, Cu, Zn, Pb, Cd, Hg in different environmental media, food products and industrial products also researches and projects to measure their levels in the environmental contents and food.

C. Basic Food Analysis Unit

This unit examines fresh and manufactured food products for their chemical and physical properties and how they comply with the standards.

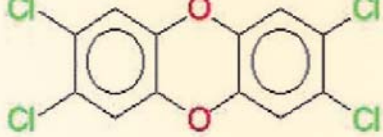
D. Water Chemistry Section

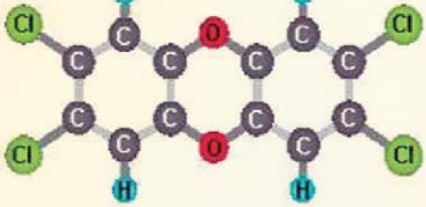
E. Micro-organism Analysis Section

F. Radioactive Materials Section

G. Lab Branches Section

Nine different laboratories are available in different parts of the sultanate for the microbiology and chemistry for the basis of food and water.





H. Quality Control Section

Several Studies have been done by this laboratory such as:

- Monitoring of precipitants of Di-2-thiocarbamate fungus pesticides on local and imported vegetables and fruits in Muscat in 2001.
- Monitoring of precipitant of Pyrethroids insecticides on local and imported vegetables and fruits in Muscat in 2002.
- Monitoring of organic pollutants precipitants in baby and infant food
- Monitoring of hydrocarbons in drinking water in all regions of Oman (done on water treatments stations, tanks, taps and mineral water).
- Study on microbial content in green salad, egg shell and in tobacco products.
- Estimation of heavy metals in herbal medicines
- Detection of hormones in meat and chicken.

Equipment

The laboratories are equipped with high quality equipment and instruments (see appendix pg. 16).

Other Laboratories (MOA)

Different laboratories are available in different parts of the country under the responsibility of MOA supporting the pesticide management. Plant pathology and entomology laboratories conduct trials for the efficacy of different pesticides on major pests attacking economically important crops in Oman. These are equipped with necessary research and diagnostic facilities. Toxicology laboratory conducts trials on the pre harvest intervals (PHI), analyzes pesticides for quality control and conducts farm surveys for pesticide contamination. The laboratory is equipped with modern analytical equipment and the staff are well trained to carry out modern analytical techniques using up-to-date methodologies. Others include the SQU and MOH labs.

Identification of gaps and shortcomings with regard to POPs monitoring

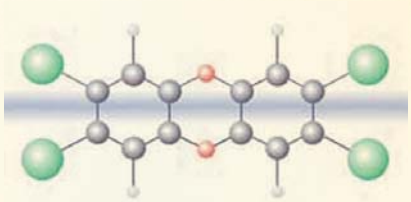
The monitoring of POPs in Oman is currently at a modest level. Some of the factors hindering the effectiveness of monitoring include the shortage of qualified human resources with the requisite technical expertise to work in the relevant fields, the lack of information on self monitoring obligations on specific pollutants among industrial establishments concerned, and the deficiencies in national capacity for quality assurance in most consumer products.

There is also the problem of information co-ordination. A national information system on POPs was proposed, which was expected to integrate information and data held by relevant departments and institutions. The information system which is supposed to be regularly updated and permit rapid access to information should ideally enhance the monitoring of POPs in the Sultanate of Oman, but it has yet to be implemented.

3. Strategy and Action Plan Elements of the National Implementation Plan

3.1 Policy Statement

Since the dawn of its Renaissance, the Sultanate of Oman has demonstrated the awareness that development may generate complex environmental problems if natural resources were misused in modern production techniques. Article 12 of the Basic Law of the State (Royal Decree 101/96) states that the Sultanate is committed to conservation of the environment and prevention of pollution. Accordingly, Oman's five-year development plans since 1975 have enunciated the basic principle of maintaining a harmonious balance between development and environmental protection. More specifically, the vision for Oman's economy (Oman 2020) which represents the Sultanate's development strategy within the period 1996-2020 reinforces the main principles of the National Conservation Strategy of 1996 which defines the objectives and procedures for creating a balance between development and preservation of the environment through the incorporation of environmental considerations in all phases of development plans. Article 29 of RD114/2001 (Law on Conservation of the Environment and





Prevention of Pollution) makes it mandatory for all sectors to "Consider environmental aspects in all phases and levels of planning in all development works towards achieving sustainable development…and to accord priority to the principle of environment protection and prevention of pollution."

For the sound management of chemicals in order to prevent their adverse impacts on human health and the environment, the Law on Handling and Use of Chemicals (RD 46/95) was issued, followed by MD 248/97 on the registration of chemical substances and the relevant permits for the control of chemicals, MD 316/2001 banning DDT and PCBs in Oman and MD 317/2001 on packing, packaging and labeling of hazardous chemicals.

In further demonstration of its determination to achieve national commitments to sound management of chemicals, the Sultanate is party to Conventions that address issues related to chemicals, namely, Rotterdam Convention, Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons, the Basel Convention and the Stockholm Convention. With particular regard to the fulfillment of its obligation to the Stockholm Convention on POPs, this NIP outlines in this section the strategies and action plans to deal with the various POPS issues.

The basic policy on POPs in Oman's NIP is to put measures in place for the gradual reduction and eventual elimination of POPs in the environment as well as their hazardous impacts on both the environment and human health. Components of this effort would include the rehabilitation of contaminated sites, prevention of further contamination through the elimination of POPs resulting from human enterprises, monitoring of other toxic chemicals and ensuring that they are handled in compliance with regulations aimed at protecting the environment and human health, and promoting the application of BAT and BEP principles.

3.2 Implementation Strategy

3.2.1 Structure and Contents

This section details the actions included in the NIP to meet the obligations of the Stockholm Convention in the Sultanate of Oman, reflecting its specific situation. Based on the analysis of the country baseline situation, considering the provisions of the Stockholm Convention as well as other relevant international treaties and national policies, pursuant to the national priorities and objectives for POPs, options were identified for institutional and regulatory strengthening, POPs management and awareness raising activities.

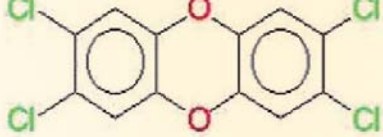
The proposed options are subjects of the particular action plans. For each option an explanatory text describes the rationale behind selecting the particular option as well as the expected capacity of the option to meet the Stockholm Convention requirements.

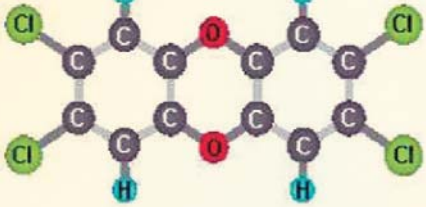
There are also tables containing information on activities associated with particular options, implementation timelines, leading and supporting agencies for implementation, indicators of success and estimated resource requirements. Links to existing country programmes on chemical management, environmentally sound waste management and environmental pollution control as well as with the national activities on sustainable development are provided as well.

The National Implementation Plan contains four action plans and four strategies as follows:

1. Strategy: Institutional and Regulatory Strengthening Measures;
2. Action Plan: POPs Pesticides;
3. Action Plan: PCBs and Equipment Containing PCBs;
4. Action Plan: Unintentionally Produced POPs by-products;
5. Action Plan: Public Awareness, Information Dissemination and Training;
6. Strategy: Research, Development & Monitoring;
7. Strategy: Measures to reduce/eliminate releases from stockpiles and wastes
8. Strategy: Information Exchange and Reporting

The issues related to pesticide and PCBs stockpiles, as well as to pesticides, PCBs and PCDD/PCDF wastes and contaminated sites, are included in the respective action plans.





Some of the overlapping issues, such as institutional and regulatory strengthening measures or awareness raising activities are mentioned in the subject-specific action plans with reference to the specific action plans, where they are elaborated in detail.

A strategy for information exchange and reporting provides the base for the reporting to the COP as well as for the future evaluation and updating of the NIP.

Strategies for research and development, identification of POPs wastes and contaminated sites and for monitoring were identified as well.

3.2.2 NIP Implementation Review, Evaluation and Updating

The implementation of Oman NIP will be subject to regular evaluation, review and updating of its various elements in line with both national and international demands.

3.3 Strategies and Action Plans

Management options for Stratigies and action Plans are Shown in twenty three tables.

3.3.1: Institutional and Regulatory Strengthening Measures

The main action on institutional and regulatory strengthening measures revolves around identifying and addressing priority needs, such as personnel, equipment and funding, of government and private establishments involved in the management of chemicals, identifying methods of enhancing communication flow among all key stakeholders under the coordination of MECA as the national umbrella, organization of training programmes for the various cadres of workers involved in chemicals management. On the regulatory side, the stress will be on adoption of new legislative measures or revision of existing ones to enhance efficiency of POPs management, in addition to developing the necessary mechanisms for the enforcement of such legislation.

3.3.2 Action Plan: POPs Pesticides

Management options

Based on the analysis of the country baseline situation, considering the provisions of the Stockholm Convention as well as other relevant international treaties and national policies, pursuant to the national priorities and objectives for POPs management, the following management options were identified:

1. Improvement of pesticide regulatory system
2. Ensure that imported and locally produced food is free of POPs residues
3. Ensure that imported pesticides comply with international and national legislation
4. Determine the sites, quantities used, and residual concentration of previously used DDT and POPs pesticides
5. Risk assessment due to the past uses of POPs pesticides and DDT
6. Determine the appropriate sites and mechanism of disposal of POPs pesticides
7. Raise awareness of medical care providers on pesticides use, possible impacts and residual effects
8. Raise community awareness on the possible impacts and proper management of pesticides

Implementation strategy

1. Improvement of pesticide regulatory system

Based on realities emerging from the assessment of POPs in the Sultanate of Oman, it is imperative that regulatory systems for the management of pesticides be improved by reviewing the relevant national law and inculcating in it relevant provisions of related international and regional laws.

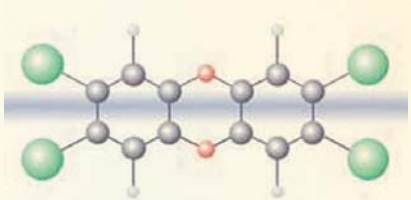





Table 51

	Management option /Activities	Timeframe	Main implementing Agency and supporting Institutions	Requested output / indicator of success	Estimated Cost $
0	1	2	3	4	5
1.	**Improvement of pesticide regulatory system**				
1.1	Reviewing and updating existing legislation and standards to reduce/eliminate POPs	2008-2009	MECA,MOA,MOH	Publication of new laws	4000
1.2	Enhancing control over smuggling and illegal entry/exit of POPS pesticides & chemicals	2008-2010	MECA,MOA,MOH,Customs	POPs-free chemicals	8000
1.3	Endorsing & publishing the law	2008-2010	MECA, MOA	The law is adopted	4000

2. Ensure that imported and locally produced food is free of POPs residues

Although there is no current use of POPs pesticides in Oman, the possibility of threats of accumulated residues from past uses and contamination from imported food cannot be discountenanced. It is therefore essential to step up the inspection of both imported and locally manufactured food to ensure that they are free of POPs residues.

Table 52

	Management option /Activities	Timeframe	Main implementing Agency and supporting Institutions	Requested output / indicator of success	Estimated Cost
0	*1*	*2*	*3*	*4*	*5*
2.	**Ensure that imported and locally produced food is free of POPs residues**				
2.1	Develop and update consumer protection standards and monitoring for POPs in food processing industries and food sold in the market	2011-2013	MECA,MOA,MRMWR,, MM,MCI	POPS-free consumer goods in markets	30,000

3. Ensure that imported pesticides comply with international and national legislation

For purposes of higher agricultural productivity to satisfy the need of a teeming population and contribute to economic progress, the agricultural sector in the Sultanate still relies on the use of pesticides. Part of the strategy to ensure that such pesticides comply with national and international legislation include the strengthening of the capacity of local laboratories to carry out regular tests on all imported pesticides and to ensure, through plant quarantine offices, that imported plant materials are free of restricted or banned pesticides.

Table 53

	Management option /Activities	Timeframe	Main implementing Agency and supporting Institutions	Requested output / indicator of success	Estimated Cost
0	*1*	*2*	*3*	*4*	*5*
3.	**Ensure that imported pesticides comply with international and national legislation**				
3.1	Strengthening the capacity of local laboratories	2008-2013	MECA,MOA,MOH,MCI,SQU	Increased reliability analytical works	30,000
3.2	Strengthening the capacity of plant quarantine offices	2008-2013	MECA,MOA	Absence of banned pesticides	20,000