Analysis of the Oregon Stakeholder Drug Take Back Public Policy Process to Reduce Pharmaceutical Pollution in Oregon's Water Resources

by

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This is to certify that I have examined this copy of a master's project report by

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and have found that it is complete and satisfactory in all respects,
and that any and all revisions required by the final
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Table of Contents

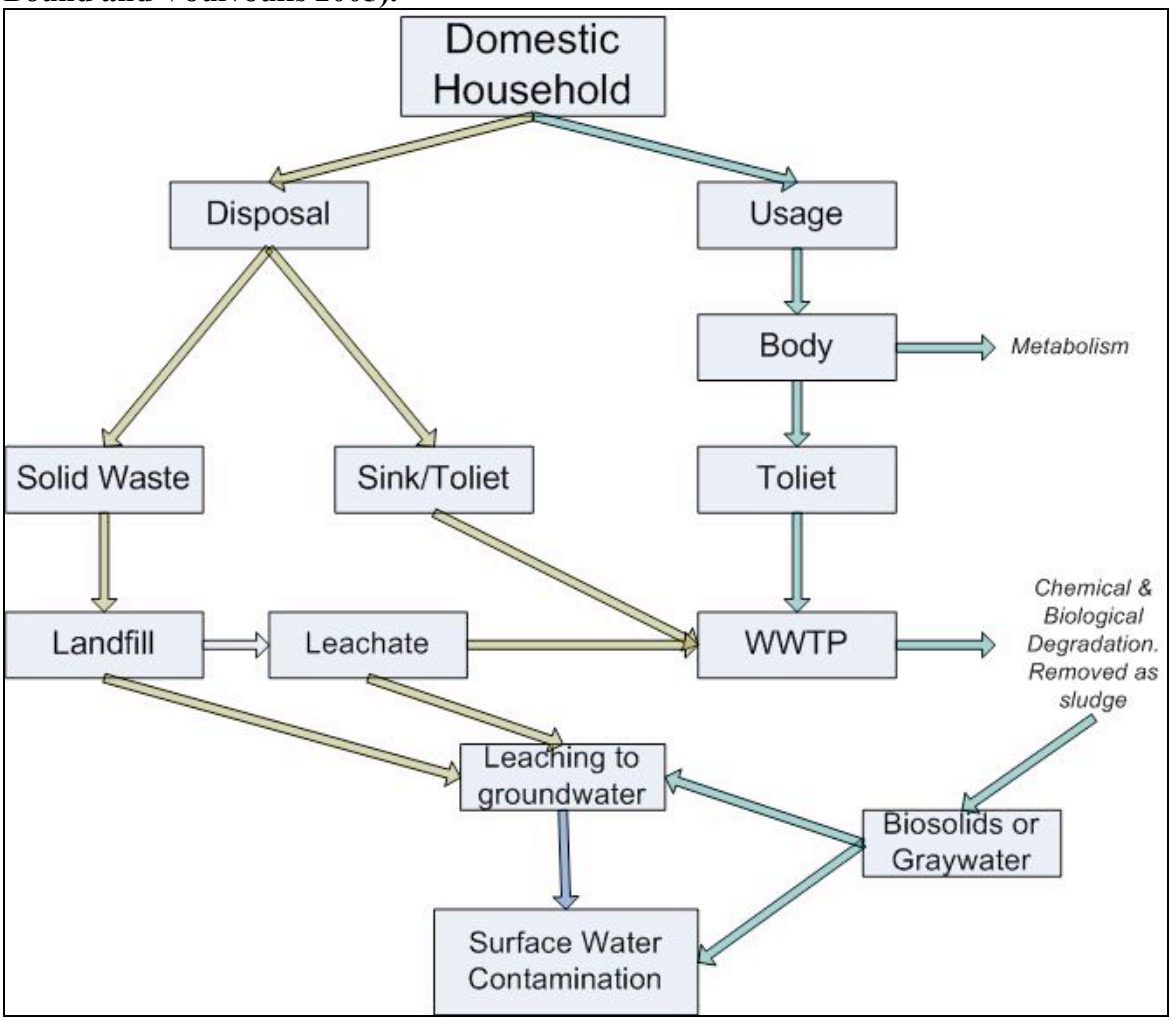
Page

1 Introduction

Within the United States, including Oregon, the social and environmental problems associated with expired and unwanted pharmaceutical drugs and endocrine disrupting compounds (EDC) are becoming more prevalent. The five major concerns with unused pharmaceuticals and EDCs are unintentional poisoning of children and adults, intentional drug abuse, impacts on water quality, effects on wildlife and aquatic species, and public health. Unless specifically called out, here on out references to pharmaceuticals will include both pharmaceutical and endocrine disrupting compounds.

There are four identified sources of unwanted pharmaceutical drugs: residential homes, long term care facilities, health care facilities such as hospitals, and veterinarian clinics. As displayed in figure 1, the two main paths pharmaceutical drugs enter the aquatic environment are excretion after use or disposal before ingestion via the trash and or the sewer system, usually after being flushed down the toilet (Daughton and Ternes 1999; Environmental Protection Agency 2006; Kostich and Lazorchak 2006). A 1993 investigation into the disposal habits of the public in the United States found that only 1.4% of people surveyed returned unused pharmaceuticals to the pharmacy, whereas 54% threw them away and 35.4% disposed of them in the sink/toilet (Kuspis and Krenzelok 1996). Furthermore, a survey in the same year of 100 hospitals found that 68% of the hospitals disposed of unused pharmaceuticals either in solid waste or down the toilet (Kuspis and Krenzelok 1996).

Figure 1: Pathway into surface and ground water by pharmaceuticals. (Adapted from Bound and Voulvoulis 2005).



Since pharmaceuticals were not commonly monitored in the past, primarily due to the lack of available of analytical techniques, and as they have the potential to cause adverse ecological and/or health effects they are labeled as "emerging" containments. Terminology is often in the eye of the beholder, and the term "emerging" is ambiguous, meaning it has the capacity to have multiple meanings (Stone 2002). The American Heritage Dictionary (2004) defines "emerging" as, "newly formed or just coming into prominence." Yet, the term "emerging" only reflects one aspect of the overall issue surrounding the need to minimize risks,

and advocates or opponents can use the term to support their claim. According to Dr. Christian Daughton, risks emanating from chemical pollution can be classified into four main categories: (1) Growing/Developing, (2) Hidden/Latent, (3) Emerging, and (4) Future (Daughton 2000). Clearly, the term "emerging" only accounts for one of four possible categories of previously unrecognized or unanticipated exposure risks that residual pharmaceuticals can fall into.

As of May 2007 the state of Oregon does not currently have a substantive policy in place to allow for the collection and disposal of pharmaceuticals from the general public. Residents who contact the Oregon Department of Environmental Quality are advised to throw them in the trash. Furthermore, pharmacies won't take unused pharmaceuticals back from a customer out of concerned with violating the Controlled Substances Act.

In September 2006, to deal with pharmaceutical contamination of waste and drinking water, the Oregon Association of Clean Water Agencies (ACWA) convened the Oregon Drug Take Back Program Stakeholder Group. The group consists of 25 official stakeholders, all with a wide array of interests and influence, and another 29 interested organizations. See appendix A for the list of official stakeholders and appendix B for the list of interested organizations. The stakeholder group is a support building, or consensus building process, which potentially avoids policy failure. According to the group charter the goal is to "work collaboratively with affected and interested stakeholders to develop a workable Oregon drug return system that collects and properly disposes of unwanted prescription drugs, controlled substances, and over-the-counter drugs from the end users" (Oregon Drug Take Back Program Stakeholder Group 2006). This group is what political scientist John Kingdon would call policy entrepreneurs, as they did not wait for the problem stream to rise and peak before working on developing a policy proposal (cited in Gosling 2004). While the charter addresses the social benefits of a program, the

ultimate goal of ACWA is to minimize the impacts of pharmaceuticals on water quality in order to avoid the costs associated of upgrading wastewater treatment plants (WWTP) around the state. In addition to any ecological and water quality benefits, a policy to manage unused pharmaceuticals would result in unintended positive social consequences. These social benefits will be the key to design a policy that's socially palatable to the general public and policy makers. Once the stakeholder completes its work it will submit to the Oregon State Legislature its findings and policy recommendations.

The goal of this analysis is to use the social construction framework to determine 1) whether the Oregon Drug Take Back Program stakeholder group can design a public policy that will ultimately reduce water contamination from the improper disposal of unused pharmaceuticals from the general public, and 2) use the framework to determine what type of policy tool the stakeholder group could use. Policy design is defined, "as the process by which policies are designed, both through technical analysis and through the political process to achieve a particular goal" (Birkland 2005:157).

This paper will first use a literature review to conduct a technical analysis on the various issues and constraints associated with pharmaceutical contamination. Next, it will analyze past, ongoing and proposed public policies that deal with unused residential pharmaceuticals in order to gain knowledge on why the policies succeed or fail. Third it will use the demonstrated behaviors of the stakeholder group members to place them into the social construction framework. Last, the analysis will use the information gained the literature review, other public policies and the framework to determine what type of policy tool the stakeholder group will use to design the public policy. While recognizing long term care facilities, hospitals, and

veterinarian clinics are also sources of contamination, this analysis will not address them at this time.

2 Methodology

For a residential pharmaceutical disposal policy there is little quantitative data available, and the process to collect and develop new data sets were outside the fiscal and temporal range of this analysis. As a result primarily empirical and qualitative information was gathered and used in the analysis. My role within the process was that as a policy analyst working for the Oregon Association of Clean Water Agencies (ACWA) to conduct research, including, but not limited to cost benefit analyses, identification of regulatory requirements and constraints, and analysis of international and national policies for best practices and failures. The majority of empirical data derived from the seven stakeholder meetings, and 32 ad-hoc phone interviews of individuals conducted from October 2006 through May 2007. Meetings lasted anywhere from three to nine hours at a time, with the location varying from the cities of Corvallis, Salem and Portland, all within the state of Oregon. At the meetings the number of participants ranged from 30 to 75. Meetings always started with a "roundtable" where each participant had an opportunity to state which organization they represented and the reasons they were there. My participation was active at all the meetings, four of which I presented analyses on program development options, funding options, and draft technical reports. It was from these that the empirical information on the stakeholders' social behaviors were collected and used in the social construction framework.

A literature review was conducted on the key social and environmental issues associated with unused pharmaceutical waste, and the regulatory requirements and constraints for the policy development. From this review further empirical analyses on the social behaviors of the

stakeholders was conducted. The stakeholders, who had access to the literature review findings, used the information to promote their own agenda using various policy setting techniques.

In addition to observations, I conducted qualitative research into public policies that deal with residential pharmaceutical drug disposal. Each of the policies had components, or lacked components, that could be construed as a success or failure. It's from these failures the predictions on which policy tools the Oregon stakeholder group will promote and how those tools could lead to success or failure.

Using the empirical and qualitative information, the organizations on the stakeholder group were placed into one of four categories within the social construction framework, with their designations based on 1) their social behaviors throughout the process, 2) how the rest of the stakeholder group perceives them, and 3) their level of influence in and outside the stakeholder group. With the framework as an analysis tool, a determination was made of which policy tool has the greatest likelihood of being adopted and which policy tool has the greatest likelihood of being successful in meeting the goal of preventing further water contamination.

3 Literature Review

The goal of the literature review was to first examine the social, environmental and economic issues associated with unused residential pharmaceuticals and improper disposal methods. Second it was to analyze the relevant regulatory issues that apply to pharmaceutical disposal and may have an impact on future regulations. Information gained from the literature review was used by the organizations on the stakeholder group to drive their own agenda or to derail another's. The social matters associated with unused pharmaceuticals coincide with the water environmental and ecological issues, as they're factors in the policy development process.

3.1 Environmental Issues

3.1.1 Water quality

The existence of drugs in surface waters, groundwater and even marine systems has been confirmed at concentrations of high milligrams per litre to low micrograms per litre, rivaling the levels of some pesticides (Daughton and Ternes 1999). For example, within the United States, a U.S. Geological Survey (USGS) study found pharmaceuticals, hormones, and other organic wastewater contaminants in 80% of the 139 streams sampled in 30 sates (Cocke 2004; Kolpin et al. 2002; Raloff 2004). A separate USGS study on the streams in the Boulder Creek Watershed in Colorado was conducted to evaluate the spatial chemical loading on the watershed level. In main stem Boulder Creek, 55% of the 22 pharmaceutical compounds analyzed were detected within the samples, including diltiazem, cotinine, and sulfamethoxazole (Barber et al. 2006). See appendix C for the list of target pharmaceutical compounds for national reconnaissance in U.S. Streams.

Unfortunately, the general public and policy makers often don't realize the causal effect disposal of pharmaceuticals via solid waste landfills has on ground and surface water contamination. Studies in Europe and the United States have shown that pharmaceuticals disposed in solid waste landfills escape in the form of leachate (Sang and Li 2005; Barnes et al. 2004; Bound and Voulvoulis 2005; Holm et al. 1995; Schwarzbauer et al. 2002; Eckel, Ross, and Isensee 1993); the liquid that contains soluble, suspended, or miscible materials removed from the waste that has passed through or emerged from the landfill. While newer landfills are designed with a leachate collection system, the leachate is still transported to wastewater treatment plants for treatment then released into surface water. In older landfills without a collection system, the leachate can infiltrate the groundwater or move to surface water. In 2000

the USGS conducted a study of the Norman Landfill located in Oklahoma; opened in 1920 and closed in 1985, the landfill did not have a leachate collection system. According to the study, the leachate plume has and continues to move in the direction of ground water flow and has migrated beyond a wetland that is about 394 feet south of the landfill. The samples collected from the plume detected 22 organic wastewater contaminants, including pharmaceuticals (Barnes et al. 2004). The list of the 15 most frequently detected pharmaceuticals in wastewater effluent is available in appendix D.

Of similar concern is the use of reclaimed urban wastewater, commonly known as "gray water", for irrigation. A 2003 study in the Front Range of Colorado looked for the presence of 19 pharmaceuticals in soil irrigated with reclaimed wastewater. Throughout the irrigation season all 19 pharmaceuticals were detected in 5-cm increments of a 30-cm cores (Kinney et al. 2006). The highest concentrations were found in the lowest soil depth, which indicates that some pharmaceutical compounds may break down or degrade as they interact the soil.

3.1.2 Ecological impacts

Pharmaceuticals have shown to have subtle, chronic effects on aquatic species, which are faced with long term exposure in the aquatic environment. The most notable impacts is the feminization of male fish by overexposure to estrogen, such as a synthetic oral contraceptive (17α ethynylestradiol), or endocrine disruptors (Raloff 2004; Crisp et al. 1998; Kostich and Lazorchak 2006; Sedlak, Gray, and Pinkston 2000). Clofibrate, a drug used to lower cholesterol, is an example of an endocrine disruptor, which by mimicking natural hormones like estrogen, alters other hormone concentrations.

On the Potomac River, downstream from a wastewater treatment plant, the USGS discovered male fish producing eggs from estrogenic exposure in birth control pills (Cocke 2004;

Raloff 2004). In the study 42% of male smallmouth bass surveyed showed signs of intersex development while a later sampling in the spring showed a rate of 79% of sexual abnormalities (Cocke 2004). The aforementioned study in Boulder Creek, Colorado showed similar results where the male to female ratio downstream of the wastewater treatment plant ranged from 20% to 30%. Additionally other indicators were observed, including gonadal intersex and the production of vitellogenin, an egg sac protein (Barber et al. 2006).

In addition to the feminization of male fish, other documented adverse ecological impacts from pharmaceutical exposure in wastewater effluent include:

- The large-scale use of antibiotics and their release into the aquatic environment is an identified cause of resistance of bacteria in streams and wildlife, such as wild geese near Chicago, Illinois (Kolpin et al. 2002).
- Selective serotonin reuptake inhibitors (SSRIs), a class of antidepressants that includes Prozac, Zoloft, Luvox, and Paxil, have been shown to induce spawning in bivalve species, such as the zebra mussels (Daughton and Ternes 1999). In addition, exposure to serotonin has shown to change behaviors in lobsters by stimulating subordinates to engage in fighting against dominants (Huber et al. 1997).
- Retinoids, which are used for various medical conditions including skin disorders, wrinkles and cancer treatments, can impact embryonic systems in amphibians, which may play a role in frog deformities (Daughton and Ternes 1999).

What's not known are the long-term effects and consequences pharmaceuticals may have on a species and an ecosystem as a whole. The concerns range from behavioral modifications, genetic alterations or the impacts to other species up and down its food chain. The effects could be subtle yet substantial over a long period of time. Additionally, as with human intake of

pharmaceuticals, there are questions regarding the combinations and interactions impacts. (Daughton and Ternes 1999).

3.2 Social Issues

3.2.1 Public Health

There is currently little evidence to show that pharmaceuticals are present in the environment in sufficient quantity to cause significant physical harm to humans. A Danish study looked at the human health from environmental exposure to three common pharmaceuticals, the synthetic estrogen 17α-ethinylestradiol, the antibiotic phenoxymethylpenicillin, and the antineoplastic drug cyclophosphamide. The results indicate a negligible human risk connected to the environmental exposure for the three substances (Christensen 1998).

Though there appears to be little direct physical harm from environmental exposure to pharmaceuticals, the health impacts from a perceived risk may be significant; also known as the "nocebo" response. The nocebo response is a real, physiological adverse outcome caused merely by the suggestion or belief that something is harmful, regardless of any inherent toxicity (Daughton 2004). Essentially, as the general public becomes increasingly aware of the issue of pharmaceuticals in the water, including the May 7, 2007 Oregonian article, some in the public may experience health problems from the nocebo effect.

3.2.2 Unintentional poisoning

Unused or expired prescription drugs can lead to serious health and safety problems, including unintentional use of expired or wrong prescriptions; unintentional poisoning of children in the home; and unintentional poisoning of children who find discarded medication in the trash. In 2004 the Oregon Poison Center (OPC), the designated regional poison center for

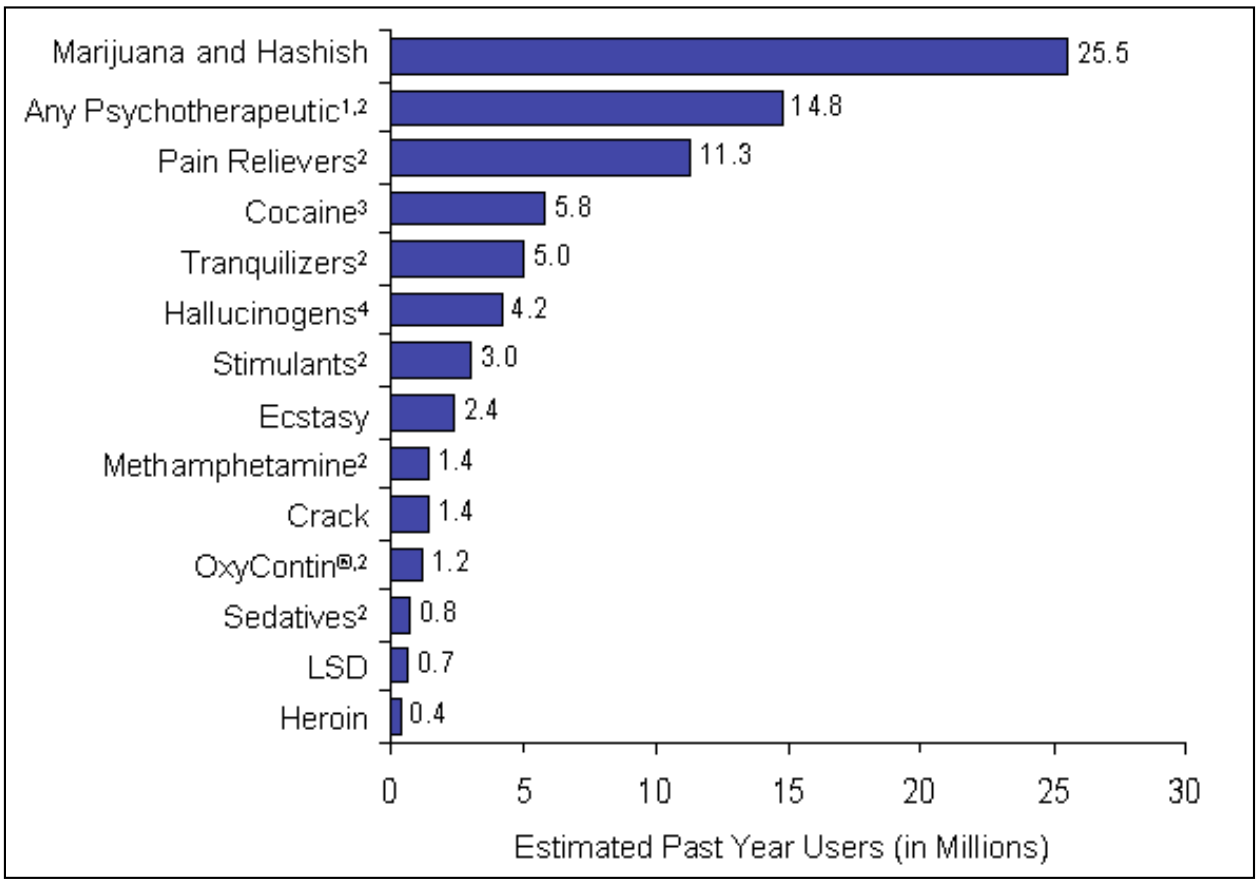
Oregon, Alaska, Northern Nevada and Guam, received 71,677 calls for assistance; 76% of the calls were regarding human exposure to poison. Pediatric (under 6 years of age) accidental poisoning represented 52% of the calls, with 28,734 cases.

Pharmaceutical drugs are the most common category of exposure, resulting in 50% of the accidental poisoning calls, and represent the most serious poisoning incidents. In 2004 poisoning from pharmaceutical drugs required 9,684 hospital visits and represented 77% of the pediatric hospital visits in Oregon in 2004 (Oregon Poison Center 2004). Within the United States, unintentional poisoning deaths are the second leading cause of injury death for 35-54 year olds and the 3rd leading cause of injury death for 25-34 year olds (Health Resources and Services Administration 2007).

3.2.3 Intentional nonmedical prescription drug use

Intentional nonmedical abuse of pharmaceutical drugs by youths, categorized as ages 12 to 17, is an issue of concern. Nonmedical use is defined by the National Surveys on Drug Use and Health as, "the use of these medications without a prescription of the respondent's own or simply for the experience or feeling the drug caused" (Colliver et al. 2006:1). Thus, nonmedical use does not include legitimate use of prescription drugs under a physician's direction, nor does it include use of over-the-counter medications. While misuse of prescription drugs is second only to marijuana as the nation's most prevalent drug problem (see figure 3.2.3.a), the annual average number of people using pain relievers non-medically for the first time exceeds the number of new marijuana users (Colliver et al. 2006). During the years 2002-2004 Oregon had the third highest rate (10%) among youths for nonmedical use of pain relievers; the highest rates were in Washington (10.7%) and Kentucky (10.2%) (Colliver et al. 2006). Oregon also ranks in the top five states with the highest prevalence of stimulant misuse for ages 12 years and up.

Figure 3.2.3.a: Past Year Users of Selected Drugs, Including Nonmedical Users of Prescription Psychotherapeutic Drugs: Annual Averages Based on 2002-2004

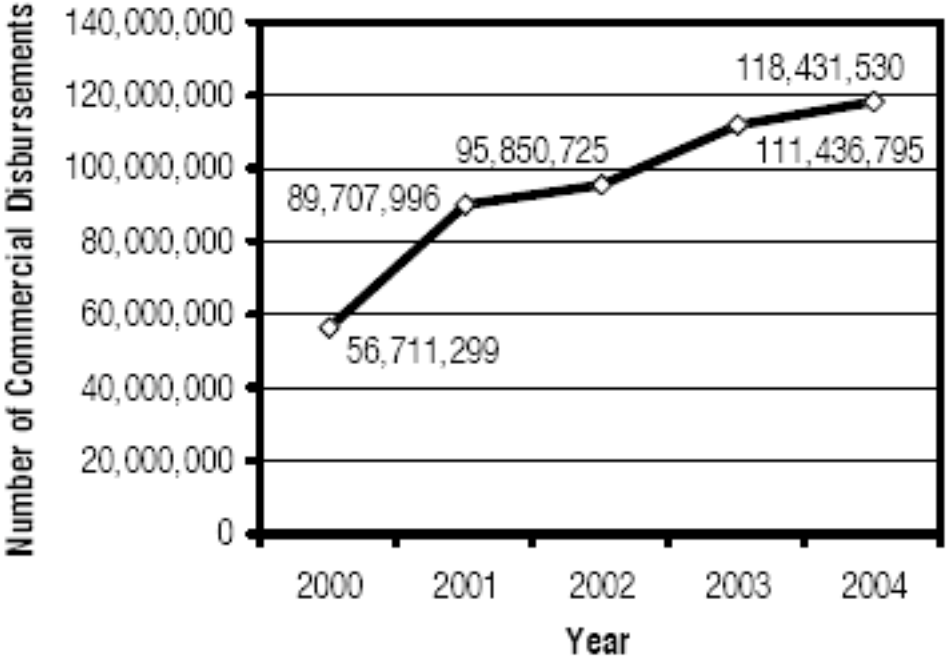


Source: SAMHSA, Office of Applied Studies, National Survey on Drug Use and Health, 2002, 2003, and 2004.
[1] Includes pain relievers, tranquilizers, stimulants, and sedatives.
[2] Nonmedical use only. OxyContin® also is included with pain relievers, and methamphetamine also is included with stimulants. The OxyContin® estimate is based on 2004 data only.
[3] Includes crack.
[4] Includes lysergic acid diethylamide (LSD), phencyclidine (PCP), and Ecstasy

The increase in nonmedical misuse of prescription drugs can be attributed to the sharp increase in commercial disbursements of controlled pharmaceuticals (prescription narcotics, depressants, and stimulants) around the nation, which has led to an overall increase of drugs available of illicit use. According to National Drug Intelligence Center's National Drug Threat Assessment of 2006, from 2000 through 2004 commercial disbursements of pharmaceuticals

increased 109%, yet during that same period commercial disbursements of commonly abused pharmaceuticals such as oxycodone and hydrocodone increased at an even greater rate of 209%, see figure 3.2.3.b.

Figure 3.2.3.b: Commercial disbursements of commonly abused pharmaceuticals[1], United States, 2000-2004 (National Drug Intelligence Center 2006).



3.2.3.1 Drug Related Medical Treatment

Nonmedical use of prescription drugs can result in unintended consequences. The Drug Abuse Warning Network (DAWN) is a public health system that monitors drug related visits to hospital emergency rooms and drug related deaths in the United States[2]. It's important to note that DAWN cannot distinguish between those cases of illicit use from the cases where a patient

[1] Commonly abused pharmaceuticals include codeine, methylphenidate, oxycodone, hydromorphone, hydrocodone, meperidine, methadone, morphine, fentanyl, cocaine, d-methamphetamine, d-amphetamine, and dl-amphetamine.

[2] Note: DAWN cannot distinguish between cases of illicit use from the cases where a patient is provided drugs and accidentally overdoses.

is provided drugs and accidentally overdoses.

According to the DAWN 2005 annual report, there were an estimated 598,542 emergency department visits in the United States for nonmedical use of pharmaceuticals, and there could be as many as 710,314[3]; a 21% increase from 2004 (Ball, Johnson, and Foley 2005). Of those, 20% involved a combination of drugs with alcohol, 20% involved a combination of pharmaceuticals and illicit drugs, and 6% involved pharmaceuticals, illicit drugs and alcohol. DAWN estimates about 404 visits per a population of 100,000. Thus, the state of Oregon, with an estimated population of 3,690,505 in 2006 (Population Research Center 2006) could have an estimated 14,910 emergency department visits per year for nonmedical use of pharmaceuticals.

While these statistics appear comprehensive, they are ambiguous. Lack of documentation inside medical records makes it impossible to determine whether or not the abused drug was prescribed or obtained illegally. Additionally, it's impossible to ascertain whether or not some of individuals included in the data are actually abusing prescription drugs, or patients that may have purposely taken more than the prescribed amount of medication to treat their pain. According to the Hospice representative during a phone interview, regulatory scrutiny has led to physicians reducing the number of prescriptions or doses of pain medication. As a result, patients are increasingly going out of the system, which includes obtaining pain medication from the Internet.

[3] DAWN cases are identified through a retrospective review of medical charts. Given the limitations of medical record documentation, DAWN concluded that distinguishing misuse from abuse reliably is not feasible.

3.3 Economic Issues

The economic costs to Oregon associated with improper disposal of pharmaceuticals are challenging to quantify. For example, the medicals costs due to accidental poisoning and intentional abuse are unavailable, but one could assume that with 576,000 Oregonians lacking health insurance (Oregon Progress Board 2007) the economic costs could be substantial.

Oregon aquatic life is susceptible to the impacts of pharmaceutical compounds, such as estrogen, and as such could counteract ongoing efforts to restore native salmon runs. In the Pacific Northwest significant amount of funding goes towards the recovery costs of endangered salmon runs, and in fact the federal government spent over $559 million on salmon recovery in the Columbia Basin in 2006. The projected funding for 2007 is $578.1 million, with about half from Congressional appropriations and the remaining half from Bonneville Power Administration (BPA) funding.

If Oregon wastewater agencies were mandated to treat for pharmaceuticals and personal care products from effluent the most likely additional treatment technologies may include microfiltration, installation of membrane filtration, and reverse osmosis. Engineering estimates calculate the installation costs of these systems at between $6 million to $15 million per million gallons of treated effluent (Stephenson and Oppenheimer 2007). Table 3.3, based on estimated winter flows, illustrates estimated costs for selected Willamette Valley communities. As these are installed estimates they don't include operational and maintenance costs, such as brine disposal, or increased energy consumption.

Table 3.3: Estimated winter flow of Selected Willamette Valley, Oregon

Community	Anticipated Wet Weather Flows	Cost Range for Microfiltration and reverse osmosis
Corvallis	75 MGD	$450 million to $1.3 billion
Eugene/Springfield (Metropolitan Wastewater Management Commission)	237 MGD	$1.4 billion to $3.6 billion
Urbanized Washington County (Clean Water Services)	335 MGD	$2.0 billion to $5.9 billion
City of Portland	450 MGD	$2.7 billion to $6.8 billion

3.4 Regulatory constraints

For a pharmaceutical drug return program five regulations potentially factor in: the Resource Conservation and Recovery Act (RCRA), Controlled Substances Act (CSA), United States Postal Service regulations, Health Insurance Portability and Accountability Act (HIPAA), an the 1996 amended Safe Drinking Water Act. As with many public policies, most of the regulations around a pharmaceutical drug return program are ambiguous, and developed in a manner that could allow for various interpretations.

3.4.1 Resource Conservation Recovery Act

The Resource Conservation and Recovery Act (RCRA) regulates the transportation, treatment and disposal of hazardous waste. Within the state of Oregon the Department of Environmental Quality (DEQ) regulates RCRA. Hazardous waste falls into two categories: characteristic and listed wastes (Environmental Protection Agency 2006). Pharmaceuticals are 'listed' hazardous waste if they are on either the "P" or "U" lists of the RCRA regulations.

Under RCRA, and in Oregon, household waste is considered exempt, and therefore not

regulated. This tends to be the case for pharmaceuticals, as ownership of the pharmaceutical remains with the consumer. The question of ambiguity comes in when large quantities of pharmaceuticals are collected in one location for disposal, as with the state of Washington's program. According to the DEQ, simply by not defining pharmaceutical as "waste" but instead defining it as "residual" or "outdated" allows a take back program to avoid RCRA regulatory requirements. Therefore, even if large quantities of "residual" pharmaceuticals are collected in one location (normally a trigger to enact RCRA) the possession of the pharmaceutical will "remain" with the owner thereby avoiding RCRA regulations.

3.4.2 Controlled Substances Act

Under the Controlled Substances Act (CSA), Title 21 of the United States Code, prescription medication falls under two categories, controlled and uncontrolled. Due to their abuse potential, controlled medications are regulated by the U.S. Drug Enforcement Administration (DEA), which enforces the Controlled Substances Act. These substances are drugs, or other substances, included in Schedule I, II, III, IV, or V of Title 21(National Archives and Records Administration 2004). The Code of Federal Regulations (CFR) Sections 1308.11 to 1308.15 breaks the schedules down based on their abuse potential, utility of medical treatment, and safety when used under medical supervision (Colliver et al. 2006):

- **Schedule I** is the most restrictive level, includes drugs or other substances with a high potential for abuse, no currently accepted medical use in the United States, and a low level of safety. Drugs and other substances in Schedule I are not approved for use, distribution, manufacture, or importation. Examples include heroin, marijuana, and phencyclidine (PCP).
- **Schedule II** drugs have high abuse potential but have currently accepted medical use in treatment, though with severe restrictions. Examples include

methamphetamine, amphetamines (Adderall®), morphine, oxycodone (OxyContin®), and methylphenidate (Ritalin®).

- **Schedule III** drugs have abuse potential less than that of Schedule I or II drugs and have currently accepted medical uses in treatment. Some drugs in this category include hydrocodone (Vicodin®) and butalbital (Fiorinal®).
- **Schedule IV** drugs have lower abuse potential than those in Schedule III and currently have accepted medical uses in treatment. These includes alprazolam (Xanax®), diazepam (Valium®), and propoxyphene (Darvon®).
- **Schedule V** drugs have low abuse potential and recognized medical uses. Examples include cough medicines with codeine (Robitussin AC®).

Any drugs not listed on schedules I-V are considered non-controlled and fall out of the jurisdiction of the Controlled Substances Act and law enforcement.

The goal of the Controlled Substances Act is to ensure there's a closed-looped distribution system, or chain of control, so a controlled substance is at all times under legal control of a person registered, or specifically exempted by the DEA, until it reaches the ultimate user or is destroyed. The regulations require law enforcement officers to take possession of any controlled substances collected and to maintain possession of them at all times, including witnessing the drug's destruction. Therefore, once a prescription is filled, only the person to whom it was prescribed or law enforcement can legally be in possession of the drug. Thus, while a pharmacist can possess controlled pharmaceutical drugs to fill a prescription, the Controlled Substances Act prohibits the same pharmacists to take possession back once that prescription is in the hands to whom it was prescribed as the drug has left the chain of control. This constraint makes developing a pharmaceutical take back and disposal program extremely challenging and costly.

Like pharmacists, DEA registered reverse distributors are permitted to handle controlled drugs until the drug leaves the closed-looped distribution system. A reverse distributor is a private business that takes back pharmaceuticals from a business licensed to handle pharmaceuticals, such as a pharmacy or clinic. They either send the pharmaceutical back to the manufacturer for a refund or they send it out for disposal via incineration. The term and category of "reverse distributor" was codified in May 2005 with the amendment of Title 21 Code of Federal Regulations (CFR) 1300.01 (b)(41). The amendments established the regulatory standards under which reverse distributors may handle unwanted, unusable, or outdated controlled substances acquired from another DEA registrant. Reverse distributors must register, provide security, and maintain accurate records for all controlled substances in their possession.

This issue with the Controlled Substances Act is it didn't take into account the removal of pharmaceuticals from residential homes. Ironically, the mission of the DEA is "to enforce the controlled substances laws and regulations of the United States…and support non-enforcement programs aimed at reducing the availability of illicit controlled substances on the domestic and international markets" (U.S. Drug Enforcement Administration 2007). While DEA's mission is to remove controlled substances, like pharmaceuticals, the design of the Controlled Substances Act inadvertently prohibits this very thing. Yet, there is room for a waiver, as §822(d) of the statute states that the Attorney General may, by regulation, waive the requirement for registration of certain manufacturers, distributors, or dispensers if he finds it consistent with the public health and safety (U.S. Drug Enforcement Administration 2002). As of March 2007, a DEA waiver has never been granted for a state run pharmaceutical drug take back program. Yet, it is possible if the state policy can demonstrate that the program would be in the benefit of public health and safety.

3.4.3 United States Postal Service

A policy to collect and dispose of residual pharmaceuticals may include the shipment of residual pharmaceuticals, including controlled drugs listed on Schedules II, III, IV and V of Title 21, Code of Federal Regulations, §1308.11 to §1308.15. According to the U.S. Postal Service Domestic Mail Manual, which contains the official standards governing domestic mail service, the mailing of controlled drugs is permitted when it is lawful under 21 U.S.C. §801 and 21 C.F.R. §1300 and if the mailer or the addressee is registered with the Drug Enforcement Administration, or is exempt from DEA registration (U.S. Postal Service 2006). Under Title 21 U.S.C. §822(C)(3) a patient who possess a controlled substance by a lawful prescription is not required to register and may lawfully possess the controlled substance (U.S. Drug Enforcement Administration 2002). Thus, the Controlled Substances Act does not prohibit the lawful owner of a prescription medication from mailing it to a law enforcement agency for destruction, and 21 C.F.R. §1307.21 allows any person in possession of controlled substances to transfer the drug to a person authorized to posses the drug, such as law enforcement.

Additionally, the USPS Domestic Mail Manual and Controlled Substances Act regulations specify packaging requirements for the mailing of controlled substances. The controlled substances must be mailed in the original container, with the label intact, in a secure envelope or package that does not indicate the parcel contains a controlled substance (U.S. Postal Service 2006).

3.4.4 Health Insurance Portability and Accountability Act

The Health Insurance Portability and Accountability Act (HIPAA) of 1996 does not apply to unwanted medications (U.S. Department of Health and Human Services 2006). While a

pharmaceutical take back policy would not have to comply with HIPAA, participants may not feel comfortable returning their prescriptions if they feel their privacy may somehow be exposed by returning medications with their names on the labels; yet sorting of drugs for disposal requires the medication information found on label next to the users name.

3.4.5 1996 Amended Safe Drinking Water Act

The Safe Drinking Water Act, Title 14 of the Public Health Service Act (42 U.S.C. 300-f-300j- 26) is the key federal law for protecting public water supplied from harmful contaminants (Carter 2006). Deemed to inflexible and expensive, especially for small water supplies, Congress amended the act in 1996. One of these changes included the establishment of a process for selecting contaminants for regulation. Located in §102(a), the process applies to contaminants that (i) may adversely effect human health; (ii) is known to occur in public water systems with a frequency and at levels of public health concern; and (iii) in the sole judgment of the Administrator, regulation of such contaminants presents a meaningful opportunity for health risk reduction. In addition, the Environmental Protection Agency (EPA) should evaluate the availability and costs of treatment techniques to remove the contaminant and assess the impacts of the regulation on the public water systems, economy and public health. Where its not economically and technically feasible to measure a contaminant at very low concentrations, EPA may establish a treatment technique in lieu of a standard (Carter 2006).

The process of getting a contaminant regulated is long and can be arduous. Every five years EPA must publish a list of chemical or microbial contaminates that meet the requirements set out on section 102(a) (i-iii). This is known as the Contaminant Candidate List (CCL), from which EPA will make a regulatory determination to regulate at least five or more contaminants on the list. In 2005 EPA published the first CCL and are now in the process of developing the

third CCL. According to EPA officials, the third list, to be finalized in 2008, will most likely include a significant number of pharmaceuticals and personal care products (Cited in Mannina 2006). This is further confirmed by the fact the National Research Council recommended adding pharmaceuticals into the universe of unregulated contaminants (NDWAC 2004). This leads to the question of whether or not a pharmaceutical drug or drugs could be one of the five or perhaps more, to be regulated under the SDWA.

3.5 Pharmaceutical Public Policies and Programs

If Oregon is to design a policy to address the disposal of pharmaceuticals by the general public, then examination of current and proposed policies and programs is prudent. Information gained from an analysis of these policies can help determine why some policies fail, or destined to fail, and why some succeed. Furthermore, these policies will help gage what type of policy tool the Oregon Stakeholder group will drive to.

3.5.1 State of Oregon

At the state level, the Oregon Department of Environmental Quality (DEQ) does not have an official policy for the disposal of unused medication. In the past pharmaceuticals were accepted at household hazardous waste (HHW) events, but this ceased due to conflict with the Controlled Substances Act. Now, DEQ informs interested residents to simply dispose of their pharmaceuticals in the trash. As a DEQ representative on the stakeholder group remarked at the February 2007 stakeholder committee meeting, "the typical caller finds this answer almost as unacceptable as flushing."

3.5.2 State of California – SB 966

The state of California's Senate Bill 966 is designed to "reduce the likelihood of

improper disposal of drugs, by establishing a program through which the public may return and ensure the safe and environmentally sound disposal of drugs and may do so in a way that is convenient for consumers and cost effective for retailers" (Simitian 2007:2). If passed, the bill would mandate that every drug retailer in California provide, at no cost, a system where consumers could take back their residual non-controlled pharmaceutical drugs. The bill only requires the collection of non-controlled drugs, it *does not apply to controlled.* As of May 7, 2007 SB 966 is located in the Senate Business, Professions and Economic Development Committee. The flaw with SB 966 is that the policy designers did not take into account the issue of controlled drugs, instead they assume the average California resident will know whether or not their pharmaceutical is a controlled drug or not. Based off past program failures, such as those in Oregon, Washington and the San Francisco bay area in California, this assumption is flawed and will ultimately lead to a policy failure. Furthermore, this type of policy could place pharmacies and pharmacists in violation of the Controlled Substances Act, which may be one reason the California Grocers Association, California Retailers Association and Rite Aid are in opposition of the bill.

3.5.3 State of Washington

Seattle and King County's Pharmaceuticals from Households: A Return Mechanism (PH:ARM) pilot program is a Interagency Resource for Achieving Cooperation (IRAC) team with participants from State Department of Ecology, Board of Pharmacy, Local Hazardous Waste Management Program in King County, Public Health, Seattle & King County, Northwest Product Stewardship Council, Snohomish County Solid Waste Management Division, Washington State Department of Social and Health Services-Aging and Disability Services, Washington Citizens for Resource Conservation, Pacific Northwest Pollution Prevention

Resource Center (PPRC), Bartell Drugs, and Group Health Cooperative. A glaring omission from the IRAC team is law enforcement, as they are the only legal entity that can take possession of controlled substances.

According to Dave Galvin, who presented at the November 2006 workshop, the goal of the pilot, which started in late 2006, is to make disposal as easy as it is to buy the product, and to keep drugs out of the environment. They hope to make it convenient to collect a large volume of pharmaceuticals, and to keep the program sustainable and inexpensive to run. The PH:ARM pilot is funded through 2008 with grants from non-governmental and governmental agencies. They propose to gain permanent funding for a state-wide program from a stewardship model with financing from pharmaceutical manufacturers.

Until it can receive a pilot waiver/exception/exemption from the U.S. Drug Enforcement Administration (DEA) to include controlled substances, the program only officially accepts non-controlled substances. The program consists of a secured metal drop box or plastic tote located within participating pharmacies where consumers can dispose their non-controlled pharmaceuticals. The metal containers, which cost about $600 each, are locked steel prototypes and require two keys for access. Inside is a 5-gallon plastic pail, visible through a window. When full, the pail is removed, sealed and shipped back to a distribution warehouse. From the warehouse, a reverse distributor/ hazardous waste vendor will ship the medication to a high temperature incinerator for disposal. A manifest system provides accountability and tracks the drugs through a written chain of control document. The PH:ARM team feels this type of system provides the security required by the DEA.

While the State of Washington has placed a great deal of human and financial capital into this program, the policy is inherently flawed for two reasons. First, the policy developers

initiated the program assuming the DEA would provide them an exemption to collect controlled drugs. Yet, the DEA has not provided an exemption, and the general thought is one will not be provided. Second, the program has not secured permanent funding; instead they assume the pharmaceutical industry will provide it for them. According to the pharmaceutical industry representative on the Oregon Stakeholder group, this is not something the industry is interested in and will resist unless mandated by the state (ACWA 2007). Essentially, the State of Washington designed and implemented an illegal and unfunded public policy.

3.5.4 State of Maine

The State of Maine is the first and only state in the United States to pass legislation for the management of unused or expired pharmaceuticals. In 2003, Maine passed Public Law 2003, Chapter 679 which created the Unused Pharmaceutical Disposal Program with the purpose to ensure the safe, effective and proper disposal of unused or expired prescriptions (State of Maine Legislature 2004). The Maine Drug Enforcement Administration (MDEA) will administer the program (State of Maine 122nd Legislature 2005).

The Maine Drug Return Implementation Group was created to develop and implement the program. In March 2005 the Group finished its work and communicated recommendations, including:

- Voluntary turn in events should be conducted by municipalities, community service organizations and law enforcement agencies. Funding for events should come from pharmaceutical manufacturers.
- Due to the state's rural nature, a mail-in program should be created with pre-paid envelopes readily available at pharmacies, hospitals, clinics, and law enforcement offices. Mailings, to include both controlled and uncontrolled pharmaceuticals, should go directly to the MDEA. Funding should come from pharmaceutical manufacturers.

- The Maine Legislature should consider legislation to establish a donation program for unused/unneeded pharmaceuticals.

The MDEA should support an amendment to federal regulations to allow citizens and law enforcement effective methods for disposal of pharmaceutical controlled substances.

The Maine program was slated to be operational by July 2006, but was delayed due to the lack of funding. In a April 2007 phone interview, the program manager stated that the program is still stalled with the hope of acquiring grants to start a pilot mail-back program (Pistell 2007). The major failure with this policy is the Maine Legislature it did not establish a permanent funding prior to passing the legislation.

3.5.5 San Francisco Area Wastewater Agencies (East Bay Municipal Utility District)

Many of the East Bay's Household Hazardous Waste programs have historically accepted pharmaceuticals at their drop off points, but most were forced to cease due to concerns centered on controlled substances and funding. To deal with the emerging problem of waste pharmaceuticals, the East Bay Municipal Utility District (EBMUD) wastewater treatment agencies collectively held 38 collection events outside local Walgreen's pharmacies throughout the region from May 13-21, 2006. According to Jennifer Jackson, the events organizer, the goals of the events were to educate the public, collect medication, and conduct a U.S. Drug Enforcement Administration (DEA) "by the book" events. During the events pharmacists segregated controlled substances from the non-controlled with police slated to be at the events to handle and remove the controlled substances. The events brought in about 1,500 people with each participant disposing on average of two pounds of pharmaceuticals. The 38 events collected a total of 3,685 pounds of pharmaceuticals, with 9% of the total collected controlled drugs (Jackson 2006). Over the course of the three days each participant filled out a survey. The

results showed that prior to the event, 45% of the participants disposed of their pharmaceuticals in the solid waste garbage, while 28% disposed of them in the toilet. Of the 1,500 participants, 74% of them stored their medication for more than a year and 57% were over 61 years old.

The events turned out to be costly, primarily due to the structure required to deal with the controlled drugs. The total cost was $90,005, including the disposal of waste at $3,645, and $86,260 for outreach and advertising. The total does not include the staff time, which required almost 2,000 hours of staff time from 19 agencies, or law enforcement officers' time. The biggest challenge was obtaining participation by law enforcement. At one event the pre-arranged officer failed to show up, leaving the event organizers in possession of controlled substances (Jackson 2006).

3.5.6 United States Fish and Wildlife Service and American Pharmacists Association

In March 2007 the U.S. Fish and Wildlife Service and the American Pharmacists Association (APhA) announced their partnership titled "SMARxT DISPOSAL". The program will use capacity building tools to persuade the public to change their behavior. This includes "educating the general public on the negative impacts improper disposal into the waterways has on the environment, aquatic resources, and public safety" (U.S. Fish & Wildlife Service and American Pharmacists Association 2007:1). The pilot began in March 2007, and will expand in 2008. Without the necessary resources for a large-scale public relations push the chances of success are minimal.

3.5.7 United States Federal Government

As defined by Thomas Dye, public policy is what government does and does not do (cited in Birkland 2005:17). In the case of residual pharmaceutical pollution, it's what the federal government is not doing, also known as the status quo. On February 20, 2007 the U.S. federal

government released its first official guidelines on the proper disposal of pharmaceutical drugs, "which are designed to reduce the diversion of prescription drugs, while also protecting the environment" (Office of National Drug Control Policy 2007:1). The guidelines are to:

- Take unused, unneeded, or expired prescription drugs out of their original containers, mix the prescription drugs with an undesirable substance, put them in impermeable, non-descript containers, and throw these containers in the trash.
- Flush prescription drugs down the toilet only if the accompanying patient information specifically instructs it is safe to do so.
- Return unused, unneeded, or expired prescription drugs to pharmaceutical take-back locations.

This can be only defined as a symbolic policy, as it's designed to appeal to people's values without any resources or actual effort behind it (Howlett and Ramesh 2003). This is evident since as of March 2007 there are only eight community pharmaceutical drug return programs, all small scale, in the entire United States; only five accept controlled drugs (Bateman 2007).

3.5.8 Summary of Policies

All the policies highlighted were started by those with good intentions, intentions based on their own values or out of necessity to mitigate a problem. Of those examined, the only policy that listed the social benefits above the benefits towards improved water quality and ecological health was the U.S. federal government; and that social benefit listed was to prevent the diversion of controlled prescription drugs. The remaining policies examined portrayed the environmental benefits first, with the social benefits as secondary. The failure of past and present policies appears to be due to for two reasons. The first is the fact the burdens of administration and financing are undersubscribed. The reason for this could be the powerful

influence of the business organizations against such a policy. For example, both the States of Maine and Washington anticipate their funding will come from the pharmaceutical industry, yet the pharmaceutical industry has stated this is not something they are willing to do. As a result the Maine program is stalled almost a full year after it was suppose to be operational and the Washington program will be in the same situation when the funds for the pilot are fully appropriated.

The second cause of policy failure is the designers failed to take into account the constraints and regulations around the policy. The main constraints ignored are the laws regarding the handling of controlled substances, as required in the Controlled Substances Act. If the policy is designed to include only noncontrolled drugs, then the policy designers essentially ignore the behaviors and knowledge of the program users who don't always know the difference between controlled and noncontrolled drugs, or they just don't care. This was the case in Oregon and California's past attempts at pharmaceutical drug disposal programs, and it will be the case for the State of Washington's program.

4 Discussion

As stated earlier, the goal of this analysis is to use the social construction framework to determine 1) whether the Oregon Drug Take Back Program stakeholder group can design a public policy that will ultimately reduce water contamination from the improper disposal of unused pharmaceuticals from the general public, and 2) use the framework to determine what type of policy tool the stakeholder group will use.

The stakeholder group, as convened by the Oregon Association of Clean Water Agencies, consists of 25 official stakeholders (see appendix A) and another 29 interested organizations (see appendix B). The group has a chartered goal "to work collaboratively with

affected and interested stakeholders to develop a workable Oregon drug return system that collects and properly disposes of unwanted prescription drugs, controlled substances, and over-the-counter drugs from the end users" (Oregon Drug Take Back Program Stakeholder Group 2006). Once complete the group's findings and recommendations will be submitted to the Oregon State Legislature in hopes the recommendations will be adopted.

To avoid the policy failures as the identified past and present policies, the group will need to design a policy that takes into account the political, social, cultural, and economic circumstances of the general public, regulatory constraints, and their own group dynamics. In addition, the stakeholders in the process design are working to ensure the policy meets the four policy goals laid out by Deborah Stone (2002) of equity, efficiency, security and liberty. Burdens of funding and administration should be equitably subscribed, while the benefits and use of the policy must be available to all Oregon rural and urban residents. The policy must be designed to make it efficient to use and administer. Lastly, it must be secure from possible abuse by administrators and external factors, such as drug abusers, while protecting the privacy of the program participants. The policy itself should be substantive, as it will provide a service to all Oregon's residents. To avoid the complexities and problems associated with numerous county and local governments in Oregon, it will be a single policy implemented at the state level.

Due to the complexities of the Controlled Substances Act, the policy design can use some aspects from previous successful policies that address nonpoint source pollutants, but won't be able follow them completely. For example, to reduce urban oil disposal into storm drains the Oregon Department of Environmental Quality initiated a program where residents can take their waste oil to collection points, such as auto parts stores. An identical program for pharmaceuticals is technically impossible unless the designated collection points were law enforcement offices, or

if the collection points only accepted noncontrolled drugs. The law enforcement option is problematic, as the general public may view visiting law enforcement may result in a negative stigma. As evident with past failed pharmaceutical collection efforts in Oregon, Washington and California, which only accepted non-controlled drugs, to assume the general public knows whether their pharmaceuticals are controlled or not, or to assume they wouldn't just bring them in anyway is unrealistic.

The policy design process is a pluralistic endeavor, with Oregon's general public of 3,690,505 residents (Population Research Center 2006) as the target population for use, and the development through the interest groups that represent the general public or potentially effected groups. Thus, the influence on the policy design does not lie with individuals, but with the interests groups participating in the stakeholder group. Yet, applying a simple pluralism model isn't fully effective, as some interests on the stakeholder group possess greater influence than others, therefore the policy process will be viewed using the framework of social construction which is defined as, "the cultural characterizations or popular images of the persons or groups whose behavior and well-being are affected by public policy" (Schneider and Ingram 1993:334).

4.1 Proposed Policy Goal and Outcomes

The overall goal of this policy is to change the public's personal behaviors to reduce pharmaceutical water pollution and avoid costly technical fixes, such as installation of membrane filtration systems at wastewater treatment facilities. A successful outcome would be measured in a reduction of pharmaceutical compounds detected in wastewater treatment plant effluent. Therefore success requires members of the public to voluntarily stop an activity, the disposal of pharmaceuticals into the trash or sewer, and start a new activity of proper disposal. Yet, water issues, especially those related to water quality, tend to be defined narrowly and technically

(Schneider and Ingram 2002). If residual pharmaceuticals are framed as an ecological or water quality issue, the general public may conclude the only solution is a technical fix, or prefer a technical fix to a change in their lifestyles. Therefore, the policy tool used by the stakeholder group should be flexible enough to publicly highlight the benefits of the policy with the general public's values.

4.2 Stakeholder Group

As mentioned earlier, the development of the policy is a pluralistic endeavor, but it's the behaviors of the organizations on the stakeholder group that's driving the process towards a adopting a particular policy tool for the policy design. While the 25 official and 29 unofficial organization were brought into the process to provide technical advice in designing a policy that meets the group's chartered goal, some are no doubt there to promote their organization's agenda. As each organization is supposed to have equal footing, this isn't the case as some have significantly more influence than others, both within and outside of the stakeholder group. The key participating organizations in the process are the:

- Oregon Board of Pharmacy (co-chair)
- City of Portland
- City of Medford
- City of Corvallis (co-chair)
- Council of Local Public Health Officials
- U.S. Drug Enforcement Administration (DEA)
- Oregon Association Chiefs of Police
- Oregon Department of Environmental Quality (DEQ)
- Oregon Environmental Council
- Oregon Hospice Association
- Oregon Poison Center

- Tualatin Valley Water District
- Oregon State Police (OSP)
- Pharmaceutical Research and Manufacturers of America (PhRMA)
- Oregon Association of Clean Water Agencies (ACWA)

There are two interests, both greatly affected by unused pharmaceuticals, which are not represented: the aquatic species and prescription drug abusers. Both the U.S. Fish and Wildlife and Oregon Department of Fish and Wildlife agencies were initially expected to participate, but voluntarily removed themselves from the stakeholder group for two reasons. First, there was concern among some stakeholders this would shift the focus from the economic and social issues, something all Oregon residents can agree upon, to another battle over fish. Second, the most powerful organization among the group, PhRMA, objected to its products being characterized with environmental problems when, according the PhRMA representative at the November 2006 workshop, "there is no scientific evidence connecting pharmaceuticals to environmental impacts." The second group not represented, the drug abusers, was not invited to participate.

4.3 Social Construction Framework

The theory of social constructing contends that social construction of groups influence the policy agenda and the selection of the policy tools, as well as the rationales that legitimate policy choices (Schneider and Ingram 1993). The implications of whether a policy will fail or succeed can hinge on the acceptance of the target population and on the extent to which the target population will accept which groups receive the benefits and which groups shoulder the burdens. Within a stakeholder process the dynamics of the interaction between the organizations can drive the process towards a particular policy tool, and whether it's accepted or rejected and

how the burdens and benefits of the tool is applied. For this process the framework of social construction will be applied to the key stakeholders to evaluate how the organizations within the categories will view the use of a policy tool, and why. For example, the advantaged category may view a particular tool as positive if they feel the burdens with such that tool is undersubscribed to them, or the dependent category may view the use of the same tool as insufficient as it would not provide the benefits needed for the dependent organizations.

According to Schneider and Ingram (1993) there are four target populations in the social construction framework: advantaged, contenders, dependents, and deviants. The advantaged group is powerful and positively portrayed; examples often include the elderly, businesses, veterans and scientists. Dependents are also positively constructed, but politically weak; examples of dependents are children, mothers and the disabled. The contender groups are those who are politically powerful and negatively constructed, such as the rich, moral majority, and big unions. Deviants are both politically weak and negatively constructed. Examples used to describe deviants are criminals, drug addicts, gangs and unpatriotic individuals. According to Schneider and Ingram (1993), public policies often benefit the advantaged while inflicting the burdens on negatively constructed deviants.

The organizations involved in the stakeholder group similarly fall into the four categories, as do the two interests not involved. The challenge with the social construction theory is the "lumping" of groups into categories. In one situation a group could fall into advantaged, but shift to contender in a different situation. Additionally, when labeling anything, whether it's a term, an item, or a group, it's the person defining the "thing" that gives it its meaning. Therefore for the sake of this analysis, the organizations on the stakeholder group will be categorized based off their behaviors within the group and their influence externally and

internally of the group.

4.3.1 Advantaged

Based on Schneider and Ingram's framework, the advantaged groups for the Pharmaceutical Drug Return policy has five members: The Oregon Board of Pharmacy, City of Corvallis, Oregon Department of Environmental Quality, and the U.S. Drug Enforcement Administration. These groups were placed into the "Advantaged" category since within the context of the larger stakeholder group, they are both powerful and positively constructed.

4.3.1.1 Oregon Board of Pharmacy

The Oregon Board of Pharmacy (Board) is acting as co-chair and as a result has relatively strong control over the policy development, and more importantly, over policy implementation. While the Board is an agency, their main goal in the policy process is to ensure their members aren't forced with an unacceptable burden, such as financing or administrating the program. Their burdens in the past in dealing with residual pharmaceuticals have been undersubscribed, and they want to ensure the pattern doesn't change, at least without compensation such as tax incentives or subsidies.

4.3.1.2 City of Corvallis, Oregon

The City of Corvallis falls into the category of advantaged for the same reason the Board of Pharmacy; as co-chair it has power to move the process in a favorable position for itself. The City and its represented is perceived as fair and likeable. Yet, other organizations with similar interests, like the City of Medford and ACWA, will free ride on Benton County's advantage status. Additionally, if a program is put in place, the City of Corvallis and other water agencies will benefit the most yet shoulder little if any of the burdens.

4.3.1.3 Oregon Department of Environmental Quality

The Oregon Department of Environmental Quality (DEQ) is looked upon positively, as in the past they have successfully helped curb nonpoint source pollution in Oregon. Their power is not financially based, like the Board of Pharmacy or PhRMA, but through its enforcement of the Resource Conservation and Recovery Act. Work on this policy has moved from initially placing the responsibility of dealing with residual pharmaceuticals on DEQ to a "yet to be determined" party. While unspoken, this shift undoubtedly has to do with DEQ's ability to kill or delay the policy simply by defining collected unused pharmaceuticals as "waste" and thus potentially under the regulatory control of RCRA. While DEQ undoubtedly want to honestly help prevent pharmaceutical pollution, a secondary reason DEQ participates is to avoid what they feel are undue burdens, such as financing of the program through municipal solid waste disposal fees or administering the plan.

4.3.1.4 U.S. Drug Enforcement Administration

The U.S. Drug Enforcement Administration is the only law enforcement agency in the process that's socially constructed in a positive manner among the other stakeholders. One key reason is the demeanor of the agency representative who appears to proactively working towards making the policy feasible. Additionally, the DEA has managed to deflect other stakeholders' anger around the Controlled Substances Act's inflexibility, by shifting the cause of the inflexibility from itself to the U.S. Congress. Like the Oregon DEQ, it also has the ability to stall or stop the policy from moving forward by invoking its control over the Controlled Substances Act and its regulations.

4.3.2 Contenders

The "contenders" within the stakeholder groups are those who possess great influence and power among the policy development process, yet are negatively portrayed by the other

stakeholders. The four organizations grouped as contenders are the Council of Local Public Health Officials, Oregon Association of Chiefs of Police, Oregon State Police (OSP), and Pharmaceutical Research and Manufacturers of America (PhRMA).

4.3.2.1 Council of Local Public Health Officials

The Council of Local Public Health Officials' participation in the process is interesting; they have the power to kill the policy simply by stating a policy is not necessary nor will it be necessary to meet safe drinking water standards. On the other hand, their participation has been limited. There is some concern among the other stakeholders that the Council may participate in the later stages of policy development and foul the process to avoid the potential burden of administrating the program.

4.3.2.2 Oregon State Police and Oregon Association of Chiefs of Police

The two state law enforcement agencies, Oregon State Police and Oregon Association of Chiefs of Police, are negatively constructed within the policy development process. Like other organizations, their main goal is to avoid the burdens of funding and administering the policy. Since the Controlled Substances Act allows for the general public to mail or dispose of unused pharmaceuticals at law enforcement agencies, the Oregon State Police or local law enforcement organizations would be logical administrators. Yet, both agencies have a secondary goal, and that's to avoid pharmaceutical drug abuse being labeled as a problem. While it's illegal to misuse prescription controlled drugs, it's not an issue of concern for either agency and as a result they want to avoid it becoming labeled as an issue. If the policy is implemented in a way that highlights the issue of pharmaceutical drug misuse and abuse then public opinion may place pressure the agencies to enforce compliance. According to the Oregon State Police, this is an issue that's almost impossible to enforce, as many abusers actually receive their pharmaceuticals

from a physician. In fact most young people aged 12 to 17 get these drugs from friends or family members, not the Internet (Substance Abuse and Mental Health Services Administration 2006).

4.3.2.3 Pharmaceutical Research and Manufacturers of America

The last, and most powerful organization categorized as a contender is the pharmaceutical trade organization Pharmaceutical Research and Manufacturers of America (PhRMA). The mission of PhRMA is to "conduct effective advocacy for public policies that encourage discovery of important new medicines for patients by pharmaceutical/biotechnology research companies" (PhRMA 2007:1). The pharmaceutical industry's social construction has been negative in the recent years due to high medication prices and their lobbying efforts with the G.W. Bush Administration. To change their construction, they initiated a public relations campaign which includes a bus that delivers pharmaceuticals to those who can't afford them and hired celebrity spokespeople. Based on observations at stakeholder meetings, PhRMA tries to give the impression that they don't care one way or another if the Oregon policy moves pass the design phase towards implementation; it just wants to guarantee the policy is developed in a way that benefits them. First, PhRMA wants to ensure that if the policy does go through it's not framed in a way that negatively portrays their industry, such as linking their products to causes of environmental degradation, or intentional drug misuse problems. Second, they want to make sure the policy doesn't set a precedent by using a stewardship-financing model, which is essentially a cradle-to-grave model where industry pays for the disposal of their products; if one state can successfully "persuade" the pharmaceutical industry to pay for a program, then others may follow suit. Yet, PhRMA's "Achilles heel" is their negative public reputation; opposing the Oregon policy could further hurt their reputation.

5.1.1 Dependents

The dependents within the stakeholder group are those organizations that would gain the most benefit from the policy, but have little influence in the policy development. These are the small municipalities, cities, Oregon Hospice Association, Oregon Poison Center and the aquatic species. As Schneider and Ingram (1993) point out, these are also the organizations with the least amount of power and funding. Oregon Poison Center wants to simply have a program in place that may help remove pharmaceuticals out of the reach of children, the elderly and teenage abusers. The small municipalities and water organizations understand that if policy doesn't change Oregon residents' social behavior, they may be forced to install expensive pollution control technology at the facilities.

A group of dependents not represented are the aquatic species who are impacted the most from pharmaceutical contaminates. While the welfare of aquatic species are in the back of stakeholders' mind, the issue is rarely raised. Instead the discussions focus primarily on the social and economic issues.

5.1.2 Deviants

Socially constructed deviants are those who posses little influence and are negatively portrayed. The one group that falls into that category are those who intentionally and misuse prescription drugs for illicit purposes. The rest of the stakeholders negatively look upon this group, not so much for their illegal drug use, but for the inflexibility of the Controlled Substances Act. The group as a whole is frustrated with the challenges the Controlled Substances Act presents in designing a legal policy, and this frustration is placed on the illicit drug users. Yet, the discussion around the policy design often highlights the social benefits of decreasing the availability of controlled pharmaceutical drugs from Oregon youths.

4.4 Policy Timing

The Oregon Association of Clean Water Agencies initiated the stakeholder process at the time it did for two key reasons. First, with Oregon's population growing, the problem of pharmaceuticals in the water is reaching a point, that without preventing further pharmaceutical water contamination, wastewater agencies might be required to provide an expensive technical fix. Second, the change of control to Democrats in the state legislature from the Republicans constituted a policy window of opportunity. According to John Kingdon, a window is when "two or more streams – the political, problem, or policy streams – are coupled" (as cited in Birkland 2005:116). For the Oregon policy the two streams are the identification of the growing problem and the electoral change in the Oregon Legislature.

In preparation of officially submitting the policy, it's already been unofficially shopped around to different legislators. Those on the pharmaceutical stakeholder group associated with water quality issues anticipate a friendly reception and hope to officially present the policy to the Chair of the Agriculture and Natural Resources Energy and the Environment House Committee once the design is complete.

4.5 Policy Setting Techniques

While unknowing even to themselves, each of the involved interest groups incorporate policy techniques to define the problem in order to bolster their agenda. This is the case for both the proponents and opponents of the policy, as evident at the first stakeholder meeting in November 2006 when each group had an opportunity to state their position on the policy.

The Oregon Poison Center, who wants to define the problem as social, used a story of decline during the November 2006 workshop. They presented three stories, one about a toddler

who swallowed his/her parent's heart medication, the second about a teenager who experimented with designer pharmaceuticals, and a third about a senior citizen who double dosed on cardiac medicine. To highlight the stories, they used charts with numbers and statistics to further demonstrate the growing problem.

At the same workshop the Tualatin Valley Water District also used a story of decline, by defining the problem as problems with water quality and ecological habitat. First, they used the USGS data to inform the conference members about the impacts pharmaceuticals have on aquatic species, but followed this up with a solution. The solution they presented is to focus primarily on low hanging fruit, essentially the long term care facilities, as they are large sources of pharmaceutical pollution.

The Drug Enforcement Administration (DEA) defined the problem as a political one and told a story of stymied progress by the U.S. Congress. According to DEA, Congress has tied its hands, and if Congress would simply change the Controlled Substances Act then DEA could allow Oregon to take controlled drugs off the street.

The wastewater agencies used a different approach. They first defined the problem as a nonpoint pollutant that cannot be treated or extracted using the current wastewater treatment methods. They characterized the problem as inadvertent, where people are ignorant of the impacts when they throw their residual pharmaceuticals down the drain. To tell their story they used highly technical language about what type of technical fix would be required, followed by scare tactics about the costs for the installation of technology.

Unlike the first four groups, who are attempting to either change the Controlled Substances Act or develop a new policy, the pharmaceutical industry, represented by PhRMA, is trying to keep the status quo and is essentially in agenda denial. When in the agenda denial

phase, certain interests groups will work to prevent a policy from reaching the official policy agenda (Gosling 2004). By working from within the stakeholder group, PhRMA is trying to minimize the problem as if to say it doesn't warrant a policy change. First, PhRMA used numbers and statistics based on their own scientific research, which is not peer reviewed, to demonstrate there's no scientific evidence of pharmaceuticals in the water impacting aquatic species or public health. Second, they cite the cause of pharmaceuticals in the water as accidental, meaning chemicals don't fully degrade after use. Third, PhRMA shifted blame from themselves, the manufacturers, and assigned it to the users of pharmaceuticals. The users are the cause pharmaceuticals are in the water, and the solution is the users need to take personal responsibility to dispose of their unused pharmaceuticals properly, not impose a new government policy. To demonstrate this, the PhRMA representative used a metaphor; people have to take personal responsibility to use the seatbelts the auto industry provides for them, something government can't enforce with a policy (never mind the fact the public doesn't have a "seatbelt" to properly dispose of pharmaceuticals, or the fact seatbelt use is regulated). Fourth, the regulatory constraints, primarily the Controlled Substances Act, of creating a policy to implement a pharmaceutical drug return program are too complex and would make any program too costly and inefficient to administer. Lastly, PhRMA used a stymied progress story; if the pharmaceutical industry were forced to bear the financial burden of the policy, then cost of pharmaceuticals would increase even more, which in turn would hurt the elderly, poor and ill.

Thus, the proponent interest groups are using stories, numbers and technical jargon to show that the benefits of a policy greatly outweigh the costs. The opponents are also using number, stories and "scientific evidence" to show that the benefits won't offset the costs.

4.6 Policy Tools Options

There are five broad categories of policy tools used today: negative and positive incentives, hortatory and symbolic, learning, authoritative, and capacity. The goal of the stakeholder group is to design a policy that will allow for the proper disposal of pharmaceuticals in Oregon to avoid further contamination of Oregon's waters. The behaviors of the organizations and how they fit into the social construction framework will drive the group towards the policy tool used for the design process. One policy tool option may oversubscribe the burdens to one organization, while another option could lead to greater success of acceptance by policy makers.

4.6.1 Incentive Tools

Incentive policy tools rely on either positive or negative payoffs to persuade use or compliance with a policy. These tools assume the participants have the opportunity to make a choice to participate or not, and can reap the rewards or face some sort of punishment. Additionally, the policy presumes those involved would not be persuaded to participate otherwise. Positive incentives include tax benefits, payoffs, or grants. Negative incentives include sanctions, charges, and force. There are implications associated between the negative and positive incentives. Sanctions and force are usually reserved for actions that the government wants to stigmatize, whereas inducements and charges are usually associated with socially acceptable behavior (Schneider and Ingram 1990).

For the Oregon Drug Take back program the incentive tools could be either positive or negative. A positive incentive would most likely involve the pharmacies, which are represented by the Board of Pharmacy. This would give pharmacies that voluntarily participate tax breaks for installing a program. The benefits of such a program would be minimal, as it would still require pharmacies to voluntarily participate, with the chances of success minimal, as the complexity and costs associated with installing such a program will be more than the economic

benefit of tax breaks. In addition, the liability associated with the potential noncompliance with the Controlled Substances Act could deter participation by the pharmacies.

There is potential for success if the Drug Enforcement Administration took the initiative to provide an exemption for the pharmaceutical drug disposal and if the pharmaceutical industry saw this as potentially a public relations benefit with little administrative burden. Yet, as a voluntary incentive this type of tool would not provide the necessary equitable distribution of a program to both rural and urban communities in Oregon.

A negative incentive would potentially be a fee charged to pharmacies, distributors, manufacturers and reverse distributors licensed in Oregon. The fees would go towards the policy development and management by the Board of Pharmacy. These fees would undoubtedly be passed down to the consumers of pharmaceuticals. Again, the benefits of a program would go primarily to the organizations in the dependents and deviants categories. The burden would be fully subscribed to the pharmaceutical industry. This option has little chance of being adopted, as the pharmaceutical industry would use their resources to portray the policy as unneeded and a tax on those who use pharmaceuticals the most, the elderly and ill.

4.6.2 Authoritative Tools

Authoritative tools are essentially laws and regulations forcing compliance. There is no incentive, other than enforcement actions, for noncompliance. This type of tool would put in place a law or perhaps propagate a new regulation for an agency to follow, presumably the DEQ or Board of Pharmacy. Like the benefits and burdens identified with negative incentives, this would place the burden heavily on the administrative agency who is either listed as advantaged or a contender, while the benefits would fall primarily with the dependents and deviants.

4.6.3 Capacity Tools

Capacity tools traditionally provide knowledge, information, resources and training to enable people to take actions needed. The goals of these tools are to increase rationality in the decision making process or to remove a barrier to allow them to act in a preferred manner. They are also used to influence agency practices and to encourage adoption of innovative programs (Schneider and Ingram 1990). The biggest barrier the stakeholder group must deal with is the issue of controlled substances, which has been the culprit in past policy failures. A capacity tool to circumvent the Controlled Substances Act barrier would be to place the burden of policy administration with law enforcement, as they're the only organizations that can legally accept and handle controlled drugs. The success of this type of capacity tool being adopted is unlikely, as law enforcement would use their influence outside the stakeholder group to prevent it from being adopted by policy makers.

4.6.4 Symbolic and Hortatory Tools

Symbolic and hortatory tools assume groups are motivated to act based off their values. The underlying assumptions are that individuals are more likely to take action to support a policy's goals if the goals are 1) promoted by government officials as important, 2) consistent with their values, beliefs, and preferences, and 3) associated with positive symbols, label, images and events (Schneider and Ingram 1990).

These types of policies assume that the members of the stakeholder group are participating due to their beliefs, or the benefits the policy will provide to the members of their organizations. Essentially, this policy tool would have to rely on the values of one or a combination of the organizations to voluntarily design and take the administrative duties of a policy. There are two advantaged organizations, DEQ and the City of Corvallis, who share the values of the dependent organizations. Those within the contender category, especially

PhARMA, would prefer this policy tool as it would remove the majority of the burdens from their organizations and place them on the organizations who need the policy the most. Yet, to be fully effective this tool would require participation from the Board of Pharmacy, who may be willing if the burdens of the program were deemed minimal.

4.6.5 Learning tools

Learning tools are primarily used to adjust policies that have been implemented by providing a feedback mechanism. Policy managers take what they learn from the reaction of participants, results, and indirect consequences to shift the policy design. Though the pharmaceutical disposal policy is not in the stage to learn from itself, it can take lessons learned from other policies, such as those listed earlier.

4.7 *Policy Tool Decision Matrix*

The stakeholder group has five policy tools available to design its pharmaceutical disposal policy. While one tool may be the preferred option by one social construction category, it may be deemed unacceptable by those in another category. The acceptance of each is often based off the equity of subscribed burdens and potential for success. Table 4.7 provides a decision matrix of the tools, and potential behavioral reactions from the social construction categories. The goal of the matrix is to determine which of the policy tools has the greatest chance of adoption by the stakeholder group and later policy makers, and which tool would be most successful in providing the desired benefits of the policy goal.

Table 4.7: Preferred Policy Tool Decision Matrix

	Policy Tools				
	Incentive		Symbolic & Hortatory	Authority	Capacity
	Positive	*Negative*			
Advantaged • City of Corvallis • Board of Pharmacy • Department of Environmental Quality • Drug Enforcement Agency	Against	Against	Pro	Against	Pro
Contenders • Local Public Health Officials • State Law Enforcement • PhARMA	Against	Against	Pro	Against	Against
Dependents • Municipalities • Hospice • Poison Center • Aquatic species	Against	Pro	Against	Pro	Pro
Deviants • Drug Abusers	Against	Pro	Against	Pro	Pro
Potential for Success	Low	High	Low	High	**High**
Potential for Adoption	Low	Low	**High**	Low	Low

5 Results

Using an analysis of the social construction framework and decision matrix, two possible policy tools emerge, symbolic and hortatory, and capacity. The capacity tool would have the greatest chance of successes in meeting the chartered goal of the stakeholder group, while the symbolic and hortatory policy has the greatest likelihood of being adopted from within and outside the stakeholder group.

5.1 Capacity Tool

Use of the capacity tool would "influence" law enforcement agencies in Oregon to follow the mission statement of the DEA, which is to divert controlled substances from potential misuse

and abuse. Essentially, with this tool state law enforcement agencies would be "persuaded" to receive controlled and uncontrolled unused pharmaceutical drugs from residents. Unlike the authoritative tool, this tool would have a slightly greater chance of adoption as only two organizations in the advantage and contender categories, the Oregon State Police and Oregon Association Chiefs of Police, would object and it's closer to staying with the status quo. PhARMA, DEQ, and DEA would not face any of the burdens with the policy.

For this type of policy tool to be used and adopted it would require the public policy to highlight the social benefits of preventing intentional drug misuse and unintentional poisoning. In this case the true goal of reducing water contamination by pharmaceuticals would be considered an unintentional consequence. Yet, the potential of this type of tool being adopted by policy makers is poor, as the law enforcement agencies would characterize such a policy as a counter to their ultimate mission of public safety, especially with fiscal limitations (Oregon State Police 2006).

5.2 Symbolic and Hortatory

As displayed in table 4.7 a symbolic or hortatory tool would have the greatest support among the organizations categorized as advantaged or contenders, and therefore have the greatest likelihood of adoption. This tool would remove the majority of the burdens from the contender and advantage organizations, while providing little if any benefits to the organizations in the dependent and deviant categories. Since the organizations listed as dependents require the policy to address pharmaceutical disposal, the burden of developing a policy would again fall to them. Ironically, like the capacity tool, in order for the hortatory tool to gain acceptance from PhARMA and the Board of Pharmacy, it would also have to highlight the social benefits and identify the benefits towards water quality and aquatic species as secondary. If this was the case,

the hortatory tool would very likely be adopted by the stakeholder group and moved up to the policy design process then placed on the policy agenda. If placed on the agenda the likelihood of adoption is high if framed as a solution to a social problem over an environmental one, as policy makers will accept a policy they can justify to their constituents in both rural and urban Oregon.

Yet, the success of such a policy tool would be minimal at best, as the use of this tool would lead to a symbolic policy, thereby no different than that of the federal government's guidelines. Therefore the goal of providing a device where residents could properly dispose of their unused pharmaceuticals would not be met. Essentially, use of the hortatory and symbolic tool would lead to a policy failure.

6 Conclusion

Within Oregon and throughout the United States pharmaceuticals in ground and surface waters are well documented as an emerging contaminant. Observed impacts from exposure to pharmaceutical drugs include the feminization of male fish, frog deformities, antibiotic resistant bacteria, induction of spawning in zebra mussels and behavioral changes. While physical public health impacts have not been traced directly to pharmaceuticals, some question, including the Environmental Protection Agency, as to whether some pharmaceuticals should be placed on the Contaminant Candidate List (CCL), and potentially regulated under the Safe Water Drinking Act.

The social issues associated with unused pharmaceuticals in households are just as prevalent. Unintentional poisoning of children and adults alike are numerous. Illegal misuse of pharmaceuticals is ever-increasing in the United States, especially by teens. Though teens can easily obtain pharmaceuticals from the internet, most still acquire them from family and friends. Granted the United States federal government recently introduced disposal guidelines to protect

households from poisoning and illicit use, but treating only the social ills will lead to the unintended consequences of exacerbating the water quality and ecological problems.

Economic costs associated with unused pharmaceuticals must be taken into account too. Medical treatment expenses for both unintentional poisoning and drug overdoses from illicit use will grow in relation of the number of events. The funds the government spends to restore salmon runs may be in vain if pharmaceutical contamination counteracts the efforts. Then there are the exorbitant capital costs wastewater treatment plant operators will have if they need to install pollution control equipment.

This is just what's known, what's not known and has yet to be fully determined are the long term and potential impacts. As water districts begin to look towards aquifer storage and recovery to store drinking water, what will the fate of pharmaceutical contamination be; will the process help break down the compounds, or will the compounds bioaccumulate? Currently the USGS only tests for 46 pharmaceuticals in their surveys, a relative handful compared to the number of compounds prescribed. How many pharmaceuticals are actually in Oregon's water resources, and how many more are to come as the pharmaceutical industry designs more varieties? As Oregon's age demographic continues to age and pharmaceutical use increases these questions become more pressing.

The Oregon Drug Take Back Program stakeholder group recognized these issues and are in the process of trying to develop a policy where Oregon residents, urban and rural both, can dispose of their unused pharmaceuticals thereby avoiding the damaging effects the recent federal government policy promote. The goal of this analysis was to determine what type of policy tool the stakeholder group may adopt, and that tool's potential for success at meeting the group's chartered goal. Based on the analysis two potential tools emerged, symbolic and hortatory, and

the capacity tool. The chances of a symbolic tool meeting the group's goal is unlikely; the capacity tool would lead to greater success, but has a steeper climb to adoption. Based on observations, this is not an insurmountable task. If the stakeholder group adopts the capacity tool, but design the policy to ensure proper funding is available to relieve the burdens associated with the financing and administration of the policy then the target agencies of Oregon law enforcement might be more willing to participate. But, the stakeholder group must also design the policy to show the social benefits first, and the ecological benefits secondary in order to gain support from policy makers in the legislature.

7 Appendices

7.1 Appendix A

Oregon Drug Take Back Stakeholders

First	Last	Organization
Brenda	Bateman	Tualatin Valley Water District
Lacey	Bettis	Oregon State Police
Abby	Boudouris	Oregon Department of Environmental Quality
Dave	Burright	Oregon Sheriffs' Association
Tony	Burtt	Board of Pharmacy
Kevin	Campbell	Oregon Association Chiefs of Police
Kelly	Champion	Covanta Marion
Mike	Dingeman	Oregon State Police
Tanya	Drayden	Oregon Poison Center
Bill	Etter	U.S. Drug Enforcement Agency
Linda	Fleming	Council of Local Public Health Officials
Jack	Geisser	Pharmaceutical Research and Manufacturers of America (PhRMA)
Janet	Gillespie	Oregon Association of Clean Water Agencies
Jim	Hill	City of Medford
Lis	Houchen	National Association of Chain Drug Stores
Sego	Jackson	Northwest Product Stewardship Council
Brett	Hulstrom	City of Portland Environmental Services
Teresa	Huntsinger	Oregon Environmental Council
Ann	Jackson	Oregon Hospice Association
Dave	Leland	Oregon Public Health Division – Drinking Water Program
Jeff	McLennan	Clackamas County Medical Examiner
Gerry	Migaki	Oregon Society of Health-System Pharmacists
Kristan	Mitchell	Oregon Refuse & Recycling Association
Tom	Penpraze	City of Corvallis
Holly	Sears	Oregon Refuse & Recycling Association
Jim	Solvedt	Polk County
Jim	Thompson	Oregon State Pharmacy Association
Lisbeth	Ward-Fowler	Oregon Poison Center

7.2 Appendix B

Oregon Drug Take Back Interested Parties

First	Last	Organization
Kim	Anderson	Sunrise Water Authority
Margo	Barnett	
Jeff	Bickford	Marion County Public Works
Jennifer	Boudin	Department of Environmental Quality
Theresa	Briggs	City of Bend
Pamela	Brody-Heine	Eco Stewardship Strategies
Larry	Chalfan	Zero Waste Alliance
Sarah	Chaplen	League of Women Voters
Rebecca	David	Oregon State Police
Karen	DeBaker	Clean Water Services
Kim	Dinan	Marion County Public Works
Jim	Gardner	Gardner & Gardner
Rebecca	Geisen	Portland Water Bureau
Bruce	Hammon	Department of Environmental Quality
Darcy	Hitchcock	Axis Performance
Sego	Jackson	Snohomish County Solid Waste Management Division
Marney	Jett	Clean Water Services
Scott	Klag	Metro
Jill	Leary	Lower Columbia River Estuary Partnership
Shawn	Miller	Oregon Community Pharmacy
Karl	Morgenstern	Eugene Water & Electric Board
Sharon	Olson	City of Eugene
Amy	Parmenter	Oregon Dept of Human Services
Peter	Ruffier	City of Eugene
Lorna	Stickel	Portland Water Bureau
David	Stitzhal	NW Product Stewardship Council
Debra	Taevs	Pollution Prevention Resource Center
John	Thomas	Sunrise Water Authority
Jane	Thompson	City of Springfield
Nancy	Toth	Eugene Water & Electric Board

7.3 Appendix C

Target Pharmaceutical Compounds for National Reconnaissance of Emerging Contaminants in US Streams (U.S. Geological Survey 2006).

Antibiotics	**Prescription**
Tetracyclines	Metformin (antidiabetic agent)
Chlortetracycline	Cimetidine (antacid)
Doxycycline	Ranitidine (antacid)
Oxytetracycline	Enalaprilat (antihypertensive)
Tetracycline	Digoxin
Fluoroquinolones	Diltiazem (antihypertensive)
Ciprofloxacin	Fluoxetine (antidepressant)
Enrofloxacin	Paroxetine (antidepressant, antianxiety)
Norfloxacin	Warfarin (anticoagulant)
Sarafloxacin	Salbutamol (antiasthmatic)
Macrolides	Gemfibrozil (antihyperlipidemic)
Erythromycin-H2O (metabolite)	Dehydronifedipine (antianginal metabolite)
Tylosin	Digoxigenin (digoxin metabolite)
Roxithromycin	
Sulfonamides	**Sex and Steroidal Hormones**
Sulfachlorpyridazine	17a-Ethynylestradiol (ovulation inhibitor)
Sulfamerazine	Mestranol (ovulation inhibitor)
Sulfamethazine	19-Norethisterone (ovulation inhibitor)
Sulfathiazole	Equilenin (hormone replacement therapy)
Sulfadimethoxine	Equilin (hormone replacement therapy)
Sulfamethiazole	
Sulfamethoxazole	**Non-Prescription**
Others	Acetaminophen (analgesic)
Lincomycin	Ibuprofen (anti-inflammatory, analgesic)
Trimethoprim	Codeine (analgesic)
Carbadox	Caffeine (stimulant)
Virginiamycin	1,7-Dimethylxanthine (caffeine metabolite)
	Cotinine (nicotine metabolite)

7.4 Appendix D

Most Frequently Detected Pharmaceuticals in Waste Water Effluent (Kostich and Lazorchak 2006)

Name	Use/s
cotinine	nicotine metabolite
codeine	analgesic
carbamazepine	anticonvulsant and mood stabilizing
sulfamethoxazole	antibiotics
caffeine	stimulant
diltiazem	calcium channel blocker
trimethoprim	antibiotic
dehydronifedipine	stimulant
1,7-dimethylxanthine	caffeine metabolite
diphenhydramine	antianginal metabolite
acetaminophen	analgesic
warfarin	anti-coagulant
sitosterol	Steroid
cholesterol	Steroid
coprostanol	Steroid

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