

TIRE RECYCLING PROGRAM EVALUATION

REQUIRED BY THE SUPPLEMENTAL REPORT
OF THE 1996 BUDGET ACT

JANUARY 1997



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OVERVIEW

Although waste tires have been a disposal problem for many years, it wasn't realized how significant a problem existed until the '80s. Landfills operators began banning waste tires, tire stockpiles proliferated, and state lawmakers proposed legislation on waste tire management. The magnitude of the problem became even clearer when further research estimated that about one waste tire per person is generated each year nationwide.

In 1989, the California Legislature passed AB 1843 (Stats. 1989, c. 974) which required the IWMB to implement several waste tire management programs. The Legislature also created the California Tire Recycling Management Fund to provide funding for the programs, with revenue generated from a fee on waste tires left at tire dealers. The originally proposed tire recycling fee of \$1 per tire was reduced during bill development to 25 cents per tire to gain passage of the bill.

During early program development, the IWMB estimated that approximately 27 million tires were generated annually in California, but revenue generation in this and subsequent years was less than expected because not all of the waste tires generated are left at dealers. Fleet operators often purchase or lease tires directly from the manufacturer, and individuals purchasing tires from a retailer are not obligated to leave the waste tires, therefore avoiding the fee.

After the initial program development, and the submittal of "Tires as a Fuel Supplement: Feasibility Study" to the Legislature, the IWMB implemented the Tire Recycling Grant program, and provided funding for loans through the Recycling Market Development Zone Loan Program. The Tire Recycling Grant Program created great interest in the existing tire recycling industry, and among businesses and individuals interested in entering this field.

Although there was great demand, the money available was insufficient to fund all of the requests. Due to this disparity, the program has become highly competitive.

For the combined fiscal years of 1992-93 and 1993-94, IWMB awarded \$2,944,390 (of which \$2,282,224 was expended), which resulted in 488,556 tires being recycled. Grants also were awarded in FY 1994-95 and FY 1995-96, and will be completed June 1997 and June 1998 respectively.

It is important to remember that these research and business development projects were not expected to recycle many, if any, waste tires. The program was designed as an innovative and aggressive attempt to assist new recycling businesses and begin or continue research into product development and new technologies. The IWMB recognized that existing uses for waste tires, such as using them for fuel in cement kilns, would not be sufficient to completely solve the problem. Research and development efforts were needed to find new solutions, and although the IWMB closely scrutinized potential recipients, it recognized at the beginning of the process that, as with all research and development programs, some of the research would not be successful. Despite the inherent risks, many new uses for waste tires have been developed thanks in part to the grant and loan programs, and the private sector is moving ahead with marketing these uses.

Prior to the allocation of the FY 1995-96 funds, the IWMB sought industry direction and input. A white paper, detailing the Tire Recycling Program since inception, was prepared and distributed to industry representatives and stakeholders. Comments on the white paper and overall program direction were solicited. Next, the Policy, Research, and Technical Assistance Committee of the IWMB held a public workshop to solicit input and recommendations for FY 1995-96 and future program direction. All interested persons were invited to the workshop which enlisted a panel of national experts and California stakeholders.

The experience gained from past grant cycles, loan awards, and contracts, coupled with the insight received from national and California industry experts, provided a solid foundation from which the IWMB is now building upon. Beginning in FY 1996-97, and continuing through FY 1997-98, the IWMB will use its expertise in crafting the Tire Recycling Program for maximum effectiveness.

I. PURPOSE

The Supplemental Report of the 1996 Budget Act (item 3910-001-0226) requires the Integrated Waste Management Board (IWMB) to provide the following information in order that the Legislature may assess and ensure the effectiveness of the grants, loans, and contracts provided:

- The results of all grants, loans, and contracts in the tire recycling program that were completed in the most recent fiscal year, including the amount of diversion of waste tires from landfills and stockpiles that can be attributed directly to these grants, loans, and contracts; and
- An identification of the kinds of activities funded by grants, loans, and contracts that have been particularly effective at achieving, or creating the potential for, waste diversion.

It is the Legislature's intent that the IWMB target its grants, loans, and contracts in the tire recycling program toward the identified types of activities that have proven to be particularly effective.

II. BACKGROUND

At the time of passage of the California Tire Recycling Act (Stats. 1989, c. 974, Chapter 17) in 1989, the extent of the scrap tire problem was estimated at an annual generation of 20 million tires with another 100 million scrap tires scattered around the state in stockpiles.

Landfilling whole tires was problematic due to their tendency to "float" to the surface as the surrounding organic materials decomposed. Stockpiles were viewed as breeding grounds for rats, mosquitoes, and rattlesnakes, and sites for potentially devastating fires.

At that time, two proposals for large tire pyrolysis projects were being seriously considered (Garb Oil in Rialto and the Texaco research facility at Montebello). The tires-to-energy plant owned by Oxford Energy near Modesto had been permitted, built, and was consuming 5 million tires per year (from both the neighboring stockpile and the annual generation). Electrical rate contracts were in the neighborhood of 9 cents per kilowatt-hour and oil was well over \$25 a barrel. There was a belief that the only solutions for the huge number of stockpiled tires were energy recovery or shredding for landfill, and the annual flow could be used in new products such as rubberized asphalt, mats, civil engineering applications, or marine reefs.

By June 1991, when the IWMB participated in a three Board meeting with Cal EPA, the estimate of the number of tires in the "legacy" piles was down to 47 million. In the 1992 "Tires as a Fuel Supplement: Feasibility Study", the estimated number of waste tires in stockpiles was 32 million. Between 1989 and 1992, no great discovery suddenly consumed nearly 70 million tires, rather the method of estimating tires in piles was refined. Today, the estimated number of scrap tires in stockpiles (either legal or illegal) is put at 30 million, the annual generation at 29 million, electric rate contracts are going at 3 cents per kilowatt-hour, and oil is \$15 a barrel. The use of tires to generate electricity or in a pyrolytic process is not currently considered to be economically viable. While the size of the problem had been reduced, the scope of the available solutions had also.

While recycling of the annual flow and the legacy piles had been promoted by Chapter 17, Chapter 16 (also enacted by Stats. 1989, c. 974) addressed ongoing storage of tires in stockpiles

and remediation of illegal piles; major and minor waste tire facilities are defined, enforcement actions listed, and civil actions for clean-up described. The chapter also included a directive for the IWMB to report to the Legislature on the use of tires as a fuel supplement.

The two activities (permitting and recycling) were placed in separate chapters but are both supported by a common fund, the California Tire Recycling Management Fund (Tire Fund). To create the Tire Fund, the original draft of the bill placed a fee of \$1.00 on the sale of each tire. During legislative negotiations, the fee was reduced to \$0.25 per tire to be collected only when a tire was left by the consumer with a tire dealer for disposal. The scope of the bill was not reduced commensurately. The bill also set limitations of 5 percent of revenues for administrative costs and 3 percent for fee collection costs. Activities to be supported by the funds included funding of grants, loans, or subsidies for recycling and use of tires; shredding of tires for storage at landfills for future removal and use, cleanup and abatement of illegal piles; and research into new processes or uses.

Since the implementation of the Tire Program, additional legislation (SB 744, Stats. 1993) acknowledged the importance of registering waste tire haulers to reduce or eliminate illegal dumping. The hauler registration program is an enforceable method to ensure that waste tires are being transported only to approved facilities (Chapter 19).

III. RESULTS OF THE TIRE RECYCLING PROGRAM

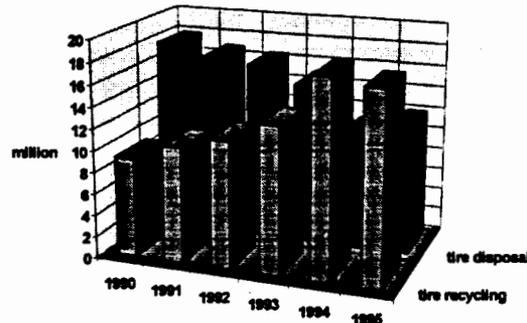
To reduce the landfilling and stockpiling of used tires, the Act called for the IWMB to award grants and loans to businesses and public entities for activities which could help develop new and expanded markets for used tires, and

divert waste tires from the annual flow (estimated at about 30 million tires/year).

The Tire Recycling Grant Program was developed and implemented, loans were offered through the Recycling Market Development Zone (RMDZ) Loan Program and the Tire Recycling Loan Program, and contracts were awarded for projects including technical research, tire recycling conferences, and tire remediation contracts.

As a result of private sector recycling efforts and the IWMB's Tire Recycling Program, waste tire diversion has increased from 35% in 1990, to 60% in 1995. Figure 1 depicts the tire recycling and disposal trends from 1990 to 1995.

Figure 1
Estimated Reusable and Waste Tire
Recycling and Disposal



Tire Recycling Grant Program

Public Resources Code §42872 authorized the IWMB to develop and implement a grant program aimed at promoting alternatives to landfill disposal and stockpiling of whole waste tires. Grants were funded from the California Tire Recycling Management Fund, and awarded competitively for business development, innovative research, and local government programs.

FY 1992-93¹

In its first year, the IWMB offered a total of \$1,973,000 from the California Tire Recycling Management Fund in through two programs: the Local Government Innovation Program (\$473,000) and the Tire Recycling Grant Program (\$1,500,000).

The IWMB awarded \$447,115 to 17 local governments through the Local Government Innovation Program. With matching funds included, total expenditures were \$887,302. The grants were used for activities including development of new uses for waste tires, for collection demonstration programs, for public education on illegal dumping, and for tire pile cleanups. Table 2 identifies the projects approved.

The IWMB received 99 applications from private businesses and local governments for funding through the Tire Recycling Grant Program. Of the 99, 28 were awarded a total of \$1,497,275. The grants were used for business development and innovative research for tire recycling. Table 3 identifies the projects approved.

The funds provided in FY 1992-93 assisted grant recipients to recycle approximately 160,532 tires, most from remediation efforts of local governments. Many of the business development and research grants created potential for future recycling into new products through development of prototypes and product demonstrations.

FY 1993-94¹

The IWMB continued offering assistance through the tire grant program in FY 1993-94 by allocating \$1,000,000 from the Tire Fund for business development, innovative research, and

¹Please see the attached tire recycling grant abstracts for FY 1992-93 and FY 1993-94 for specific project results.

local government assistance. The IWMB received 96 applications for funding and 22 were awarded a total of \$1,000,000.

The funds provided in FY 1993-94 assisted grant recipients to recycle approximately 359,946 waste tires during the grant cycle, with further increase in future potential.

FY 1994-95²

The IWMB continued offering assistance through the tire grant program in FY 1994-95 by allocating \$1,357,023 from the Tire Fund; \$700,000 for business development and research, and \$657,023 for local government programs. The allocation for local government programs was more than double the previous year's to provide more incentive to clean up and recycle stockpiled and illegally dumped tires. The IWMB received 87 applications for funding and 31 applicants were awarded a total of \$1,357,023. Staff estimates that approximately 225,000 tires will be recycled with these funds. Results will be available upon completion of all grant projects in June 1997.

FY 1995-96²

The IWMB continued offering assistance through the tire grant program in FY 1995-96 by allocating \$500,000 from the Tire Fund. An additional \$200,000 was offered to the Local Conservation Corps for recycling, cleanup, and public education. Because no loans were awarded (see Tire Recycling Loan Program, Page 4), the grant program received an additional \$300,000, making a total of \$800,000 available for grants.

The IWMB received 62 applications for funding and 10 applicants were awarded \$820,000 (\$20,000 from prior year contract savings). The

²Abstracts for FY 1994-95 and FY 1995-96 grant are not available because all of the projects have yet to be completed.

Local Conservation Corps were each awarded \$18,181.

Staff estimates that approximately 575,000 tires will be recycled with these funds. Results will be available upon completion of all grant projects in June 1998.

FY 1996-97

The IWMB allocated \$900,000 for four individual grant programs in FY 1996-97, as listed below:

Local Enforcement Agency	\$200,000
Local Government Cleanup	\$250,000
Playground Cover	\$250,000
Rubberized Asphalt	\$200,000

The Local Enforcement Agency Grant Program is a pilot program for assisting in the prevention of illegal disposal and inspecting of stockpiles. The Local Government Cleanup Grant Program will provide funds for cleanup of small sites and requires a 50% match. Both the Playground Cover and Rubberized Asphalt Grant Programs are available for local governments and require a 50% match. All grant programs are currently under development, and will be implemented prior to the end of the fiscal year.

Tire Recycling Loans

The IWMB has offered loan funds through two programs: the Recycling Market Development Zone (RMDZ) Loan Program, and the Tire Recycling Loan Program. The offerings differed in several areas including eligibility, funds available, and application period.

Recycling Market Development Zone Loan Program

In an effort to promote recycling and foster business development, legislation was passed requiring the IWMB to implement the RMDZ program. The program required the IWMB to accept applications from local governments,

designate 40 Recycling Market Development Zones (Zones) in the State. Zones are comprised of entire cities or counties, contiguous cities, and portions of cities including industrial districts. Recycling businesses siting in the Zones are eligible for local incentives, and may apply to the IWMB for a low-interest loan.

Although tire recycling businesses in the Zones are eligible for RMDZ loan funds, revenue from the California Tire Recycling Management Fund (Tire Fund) has been used to augment the RMDZ Loan Program when tire recycling businesses were to receive a loan.

The RMDZ Loan Program has received ten applications for tire-related projects (eight crumb rubber facilities, one retreader, and one rubber mat manufacturer). Four loans were approved: two were funded and two were withdrawn by the applicants after approval. The two projects funded are described below.

Loans to Tire Recycling Businesses

Tigon Industries Loan. In 1993 \$500,000 (tire funds) was approved for establishing a startup crumb rubber facility. The principals involved with Tigon inadvertently purchased equipment which limited the market they could access. Unfortunately, they miscalculated both the time and cost of becoming operational, and the market for crumb rubber. As a result, Tigon ran into financial difficulties and is currently in default. Tigon would have recycled about 1.7 million tires annually.

Parco Recycling of California, Inc. Loan. In 1995 \$1,000,000 (\$850,000 from the Tire Fund) was approved for establishing a startup crumb rubber facility. Parco is a subsidiary of a large, well established out-of-state tobacco company. Parco represented a horizontal diversification of the parent company. The company chose to expand in an area where they had experience operating similar types of equipment and production operations

(tobacco shredding versus tire shredding). The company also sought and obtained crumb rubber contracts prior to startup. As a result, Parco has been performing well in the market place. Parco anticipates recycling about 1.5 million tires annually.

Tire Recycling Loan Program

The competitive Tire Recycling Loan Program was developed in FY 1995-96. Funds totaling \$600,000 were available state-wide to tire recycling businesses. The RMDZ Loan Program's financial criteria was used to supplement the existing technical criteria from the Tire Program. Unlike the RMDZ Loan Program, staff did not assist loan applicants in developing the application materials due to the competitive nature of the program.

In this first loan offering, six applications were received by the final filing date. Two applications were disqualified for failure to meet the minimum eligibility requirements and two applications failed to receive the minimum score required. The remaining two applications received passing technical scores, but were withdrawn after not being recommended for funding due to a financial analysis questioning their ability to repay the loans. Unused funds were reallocated to augment the Tire Recycling Grant Program.

Because of the unsuccessful loan offering in FY 1995-96, a contract for the evaluation of the IWMB's Tire Recycling Loan Program will be let by June 30, 1997. The evaluation will include recommendations for making the program more effective and attractive. Results are anticipated by June 1998.

Tire Program Contracts

Revenue from the California Tire Recycling Management Fund has been used to fund contracts for program activities including site remediation and stabilization, public education, and marketing and technical research.

FY 1991-92

An Interagency Agreement, for the amount of \$500,000, was awarded to Caltrans, Division of New Technology, Materials, and Research, to: 1) purchase equipment; 2) perform testing to lead to the development of specifications for the use of tire rubber in asphalt concrete and 3) to perform air emissions testing during the recycling of pavement containing tire rubber. The equipment has been purchased and installed at the Caltrans laboratory. The IWMB is continuing to work with Caltrans staff to resolve a few remaining issues.

The Air Resources Board (ARB) was awarded an Interagency Agreement for \$160,000 to provide emissions testing of tire derived fuel (TDF) combusted at a cement manufacturing facility and a biomass combustion facility. Test-burns using TDF were conducted at a biomass facility in May 1994, and a long cement kiln in May 1996.

The biomass facility (Shasta Wheelabrator) used two-inch minus tire chips for TDF. No problems were encountered in fuel handling or combustion. The TDF was added at the rate of 10 percent of energy input. The facility has decided to not use TDF as a supplemental fuel because the price of their baseline fuel has decreased. Test data are available from IWMB staff.

The cement kiln test was performed at Riverside Cement's Oro Grande facility. Test data should be available in 1997.

FY 1992-93

An Interagency Agreement for \$500,000 was awarded to Caltrans to install 15 test maintenance strategies of various "recipes" of asphalt rubber pavements, provide ongoing monitoring and testing, and provide biennial reports to the IWMB for up to 15 years. The test strategies have been placed on State Route 16 in Yolo County. The project report, which provides details of the installation, is available from the IWMB.

Beginning mid 1997, biennial progress reports including information on current status, test results and evaluations, strategy performance and failures, and life-cycle analyses will be available.

A contract was awarded to CalRecovery, Inc., for \$69,000 to research existing pyrolysis projects in the nation. The final report indicates that pyrolysis, gasification, and liquefaction technologies are not yet economically viable. An increase in the cost of crude oil, the creation of high-value markets for carbon black, or a breakthrough in the carbon char purification process could alter the viability of these technologies significantly. The final report will be available June 1997.

The California State Fire Marshall was awarded an IAA for \$350,659 to provide training and consultation to local fire authorities, identify waste tire sites not presently registered with the IWMB, and oversee laboratory and field research conducted by the University of California, Berkeley, on burn characteristics of tires. Results of the contract include technical assistance to local fire prevention officers and tire recyclers, development and distribution of a training curriculum, production of an educational video, distribution of student manuals, and classroom instruction of local fire department personnel.

R. W. Beck & Associates was awarded a contract for \$40,000 to research the characteristics and possible uses of tire combustion ash. Sampling and testing of fly and bottom ash from two facilities was performed. Results varied depending on the source of ash. Fly ash from the biomass facility co-firing tire rubber had a relatively high nutrient level, but an elevated level of zinc. Bottom ash from this facility had a low nutrient value, and would not be suitable for agricultural applications. Fly ash from the dedicated tire combustion facility can be marketed to zinc smelters, while the bottom ash could be utilized in several markets including steel and cement manufacturing, and road construction. Cal

Recovery recommended further ash testing and demonstrations.

The IWMB awarded \$36,000 to the Local Government Commission to plan and conduct a conference aimed at promoting alternatives to landfill disposal of whole waste tires. The Conference was held on April 1 & 2, 1993, in Los Angeles, California, and was attended by approximately 200 people. Results included promotion of tire recycling, industry interaction, public education, and industry input on program direction and priorities.

FY 1993-94

An IAA was awarded to Lawrence Livermore National Laboratory for \$50,000 to investigate the environmental effects of waste tires on the environment. The project required a literature search, a review and assessment of information obtained, and recommendations for additional study. Because of the gaps in the available literature, definitive results on the effects of tires on the environment are not available at this time. The report identified laboratory investigations which would provide the additional data required to complete the research.

Two IAA's were awarded to the University of California, Davis, for a total of \$100,000 to investigate the domestic and foreign markets for waste tires and tire rubber; identify existing recycling technologies, recycling programs, and recycling ordinances and laws; identify and research industry trends and tire supplies; and to provide findings and recommendations. Results of these studies have provided the IWMB with additional information on California markets for tire rubber, and will assist with future market development initiatives.

Two Interagency Agreements totaling \$100,000 (\$50,000 each) were awarded to Dr. James Crossfield, CSU, Fresno, and Dr. Eugene Tseng, UCLA Extension, for development of a methodology for estimating the number of tires contained in a waste tire pile. The contractors

conducted field tests to determine volume and compaction analyses. Contract figures indicate that the number of tires estimated using the method developed by CSU Fresno fell within 5 percent of the actual number of tires removed during a tire pile remediation.

FY 1994-95

The IWMB allocated \$250,000 for implementation of the waste tire hauler registration program (SB 744, Stats. 1993). The funds were instrumental in developing a database for tracking waste tire hauler registration activity and developing and printing of four-part manifest forms, registration cards, and vehicle decals.

Sukut Construction was awarded \$800,000 for remediation and stabilization of waste tire sites identified and approved by the IWMB.

T.A.G. Resources was awarded \$200,000 for providing consulting services for permitting and enforcement activities.

To promote tire recycling, encourage industry interaction, provide public education, and obtain industry input on program direction and priorities, an Interagency agreement was awarded to CSU Sacramento for \$35,000 to develop and produce the Second Biennial Tire Recycling Conference. The event was held in Sacramento, California, on May 15 and 16, 1995, at the Hilton Inn, and was attended by approximately 175 people. Major topics of interest included business and market development, tires as fuel, rubberized asphalt concrete, permitting and enforcement, and local government programs.

FY 1995-96

The IWMB allocated \$750,000 for a remediation and stabilization contract. Moneys are used for either completely remediating tire piles or stabilizing them by installing fencing, creating fire lanes, and providing fire suppression equipment. The contract award

process was not completed, and the funds will be re-allocated in FY 1996-97.

An IAA was awarded to GeoSyntec for \$245,000 for investigating civil engineering applications which use waste tires. Results are anticipated by June 1998.

The IWMB awarded \$40,499 to Dames and Moore for collection and analysis of data on emissions generated from facilities using tires as a fuel supplement. The contractor has completed the data compilation phase and is now performing the data analysis. A draft report should be issued by March 1997. Final results are anticipated by June 1997.

The IWMB awarded \$38,841 to California State University, Sacramento, for developing and producing two workshops on the use of crumb rubber in products and Rubberized Asphalt Concrete. The objective of the workshops is to solicit and invite industry representatives knowledgeable on these topics, and to make this expertise available to local government officials. Both topics will be discussed at the two events scheduled for May 23, 1997 in Monterey, California, and May 30, 1997 in Anaheim, California.

IV. TIRE RECYCLING PROGRAM EFFECTIVENESS

In order to discuss the effectiveness of the Tire Recycling Program, individual program components (often even individual grants, loans, or contracts) must be evaluated separately due to the great diversity of activities funded under this program. Because grants and contracts are typically awarded with a two year term, results from awards in FY 1994-95 and FY 1995-96 are not yet available. Results from grants and contracts awarded in FY 1992-93 and FY 1993-94 are presented in this section.

Tire Recycling Grant Program

The Tire Recycling Grant Program was initially developed and implemented in FY 1992-93. Grants have been awarded for many types of activities in the categories of Business Development, Innovative Research, and Local Government Assistance. The funds allocated varied year-to-year.

Business Development Grants

In FY 1992-93, business development grants were awarded to eight companies for activities including product demonstrations, market development, and equipment purchase. Four "business development" grants were also awarded to local governments for activities including development of business recruitment plans and conducting marketing research. In total, \$416,898 was awarded for business development.

In FY 1993-94, five business were awarded \$316,535 for business development grants for activities including market analysis, business expansion, equipment purchase.

Of the 17 business development grants awarded (totaling \$733,433), 10 were successful in accomplishing all of the objectives of the project. Three grant recipients were successful in completing a percentage of their project's objectives. Four projects did not reach fruition due to circumstances beyond the IWMB's control. Reasons for non-completion include business failure, change in business plans, and non-acceptance of the terms and conditions of the agreement. Although 13 projects were successful, ascertaining the effectiveness of a grant to a particular business is difficult. Businesses developing new products may take several years to achieve full commercialization.

For example, BAS Recycling, Inc., currently a producer of crumb rubber, received a grant for the purchase of a new piece of recycling equipment. Company officials state that due to the new equipment, they are able to recycle an additional 200,000 tires per year. Conversely,

AET Systems received a grant for demonstrating the use of porous drip line pipe for a sub-surface, waste-water-effluent dispersion system, replacing a portion of the existing aeration system in Angels Camp, California. Although this individual project used only the equivalent of 90 waste tires in porous drip line pipe, the potential for this type of product is significant.

Of the \$733,433 awarded for business development, \$441,728 (60 percent) was spent for these activities. The remaining \$291,705 was unused for the reasons discussed above, and was reverted back to the Tire Fund. As a result of these grant awards, a playground cover system developed, a sub-surface, effluent dispersion system was constructed, three businesses were expanded, four local governments developed business recruitment packages, and 200,090 tires were recycled.

Listed below are the three businesses that were expanded:

- B.A.S. Recycling, Inc.
- Create-a-Saurus (City of Oakland)
- Manhole Adjusting, Inc.

Innovative Research Grants

In FY 1992-93, innovative research grants were awarded to 14 businesses and entrepreneurs for activities including product development and tire processing research. Ten "innovative research" grants were also awarded to local governments for product development and demonstration activities. In total, \$1,330,792 was awarded for innovative research grants in FY 1992-93. In FY 1993-94, six businesses and individuals were awarded \$383,465 for research grants for activities including product development, product testing, and market analysis.

Of the 30 grants awarded (totaling \$1,714,257), 21 completed the objectives of the project successfully. Eight grant recipients were successful in completing a percentage of their

project's objectives. Two projects were not completed due to circumstances beyond the IWMB's control. Several reasons for projects being partially completed or not completed include the lack of permits, the break-up of a business, and business failure.

Because of the nature of research, and the fact that even successful results are not often implemented immediately, most of the research efforts did not include direct tire recycling. Several successful grant projects that have the potential for significant future waste tire utilization include playground safety mats (BAS Recycling, Inc.), residential roofing shake (Burke Industries), soil amendment (City of Lancaster), and electromagnetic radiation absorbers (SRI International).

Of the \$1,714,257 awarded for innovative research, \$1,402,559 (82 percent) was spent by the grant recipients. The remaining \$311,698 was unused for the reasons discussed above, and was reverted back to the Tire Fund. As a result of these grant awards, ten products were developed, four processes were demonstrated, four demonstration projects were constructed, and 33,218 tires were recycled.

Listed below are products that were developed:

- Sound Barrier Prototype
- Residential Roofing Shake
- Playground Safety Mat
- Compost Bin
- Railroad Tie
- Traffic Delineator
- Rubberized Slurry System
- Electromagnetic Radiation Absorber
- Flowable Concrete
- Solid Bicycle Tire

Listed below are the processes that were demonstrated:

- Ozone Decomposition

- Ultra High Pressure Water Jetting
- Loose Playground Cover
- Rubberized Asphalt Concrete

Listed below are the demonstration projects constructed:

- Landfill Liner Protection
- Soil Amendment
- Rubberized Coating

Local Government Assistance Grants

Although 14 local governments were awarded grants in FY 1992-93 for business development and innovative research, 9 grants totaling \$196,700 were also awarded for activities including cleanup of tires illegally disposed of, development and production of amnesty events, and development and distribution of public education materials. Eleven local governments were awarded \$300,000 in grants in FY 1993-94 for similar activities.

Of the 20 grants awarded for local government assistance (totaling \$496,700), 19 completed the objectives of the project successfully. One grant recipient did not complete the objectives of the project because they would have duplicated work already completed by the State Fire Marshall.

Although grant awards for local government cleanup and amnesty programs result in immediate recycling results, these programs often stop after completion of the grant project because of the lack of funds for continued operation. The tires recycled during these programs are also not typically from the annual waste tire flow, and therefore do not directly impact the overall tire recycling rate. Local government assistance grants for cleanup and amnesty programs, therefore, appear to be very effective in the short term.

Of the \$496,700 awarded for local government assistance, \$437,937 (88 percent) was utilized by the grant recipients. The remaining \$58,763

was unused and returned to the Tire Fund. As a result of these grant awards, 14 public education campaigns were implemented, 68 tire amnesty events were held, 254 small tire piles were cleaned up, 255,328 tires were recycled, and 31,922 tires were shredded and landfilled.

Summary

Table 1 at the end of this report lists the FY 1992-93 and 1993-94 grant recipients, and provides a tabulation of funds spent for a variety of recycling end uses and indirect recycling activities. Table 2 at the end of this report is similar to Table 1, but provides a tabulation of grant funds *awarded* (because these projects are not yet completed) rather than spent, in FY 1994-95 and FY 1995-96.

Tire Recycling Loans

Several factors have made loan offerings to tire recycling businesses problematic including the relative youth of the industry, the high-risk of startup businesses, and underdeveloped markets for products for feedstocks applicants propose to manufacture with loan-funded equipment. The loan offering made by the Tire Recycling Loan Program may also have been discouraging due to the limited funds available and the competitiveness of the program.

Due to the newness of the tire recycling industry, and the high turn-over rate of businesses, many of the oldest businesses in it are still relatively young. Many companies are barely out of the startup stage, and more people are forming new businesses every day. Often, businesses decisions are made based on misperceptions, or a lack of understanding of the industry and its markets. For these reasons, loan offerings to this industry are generally high-risk.

The loan offering from the Tire Recycling Loan Program in FY 1995-96 was problematic because of the limited amount of funds available and the short application period specified. Because of the limited revenue available in the

Tire Fund, and the direction to distribute them among several programs, only \$600,000 as available for loans. Potential applicants may have thought the funds not worth their time, too competitive, or insufficient for their needs. The short application period and technical criteria may also have discouraged potential applicants from risking their time and submitting a hastily-prepared application.

Tire Program Contracts

The contracts listed below have been identified as particularly effective in stimulating recycling and market development.

Caltrans Rubberized Asphalt Demonstrations

The Caltrans Rubberized Asphalt Demonstrations contract has been effective for a variety of reasons. First, by placing 15 different maintenance strategies at one location, Caltrans may be able to eliminate variables affecting performance and longevity from the construction process. The strategies will be monitored over a 15 year period, and the IWMB will receive biennial progress reports. Also, because of the close proximity of the strategies, local government officials may be more likely to visit and inspect the site.

Caltrans Equipment Purchase and Specifications Development

In order to promote rubberized asphalt concrete, the IWMB contracted with Caltrans for the purchase of several pieces of equipment which will assist them in the development of performance-based specifications. Performance-based specifications will provide an alternative to the current recipe-based specifications, and will encourage greater use of rubberized asphalt concrete. Increased use of rubberized asphalt concrete creates a demand for crumb rubber, and improves the recycling rate of waste tires. Caltrans will reimburse the IWMB through in-kind services and use of the

testing equipment for IWMB-designated projects.

Air Resources Board Emissions Testing

The emissions testing completed at the Shasta Wheelabrator biomass combustion facility in Anderson, and the Riverside Cement Company's cement kiln in Oro Grande will provide both the biomass combustion and cement manufacturing industries with valuable data. The data can be used and analyzed by any business wishing to use tires as a fuel supplement. Also, because the testing was done by the Air Resources Board, there should not be any question regarding the validity of the data or the methods in which it was obtained.

As a follow-up, the IWMB has let a contract for collecting and analyzing currently available emissions data, including the data obtained from the Air Resources Board Emissions Testing contract.

Tire Recycling Conferences

The IWMB's tire recycling conferences, held in May 1993 and April 1995, have proven effective in the promotion of tire recycling. Both conferences were well attended by tire recyclers, equipment manufacturers, tire haulers, and researchers, and provided a good forum for the exchange of ideas and information. Permitting and Enforcement staff were also able to educate and assist the regulated public on the IWMB's Waste Tire Hauler Registration program and Waste Tire Facility Permit program. IWMB staff also benefited from the events by receiving valuable feedback on the IWMB's Tire program.

V. CONCLUSION

In the first two years of the Tire Recycling Program, the IWMB spent over \$5 million of the Tire Fund on grants, loans, and contracts. Activities in each of these programs were focused on developing tire recycling options,

promoting businesses and markets, and demonstrating tire recycling processes and technologies. During this time, private businesses were also conducting research, developing products and markets, and investing in tire recycling technologies and equipment.

Since 1992, the IWMB has estimated the number of tires generated and recycled each year, and published this information in the Tire Recycling Program Annual Report for submission to the Legislature. Annual estimates generated in this document provide an effective measure of the overall tire recycling rate in California. The IWMB has estimated that the tire recycling rate has increased from 34 percent in 1992, to 60 percent in 1995. Although much of this 26 percent increase is directly attributable to the private sector, the IWMB has contributed to this effort, and will continue to provide impetus for future expansion of markets.

Tire Recycling Grant Program

In crafting the Tire Recycling Grant Program, the IWMB sought to cast a wide net and take some risks by funding innovative technologies and processes in order to reach as wide an audience as possible and draw the greatest number of new technologies. One of the lessons learned from the program's first years is that not one, but a range of solutions are needed to absorb the 30 million tires generated annually in California. This number will continue to increase as the state's population grows. Although the recycling rate for waste tires has increased from 34 percent to 60 percent, even the cement manufacturing industry, which presently consumes almost 6 million tires, and which could potentially be expanded to burn up to 24 million tires, needs to be supplemented by other markets.

When estimating the costs and benefits of the Tire Recycling Grant Program, benefits other than the number of tire recycled must be considered. Other benefits include completed

research for future product commercialization, demonstration of a technology's viability, invalidation of a process or technology, education of the public regarding illegal disposal, fostering start-up and developing businesses in support of the tire recycling industry, and future environmental benefits from increased recycling, reduced tire stockpiling (reduced risk of fire and resulting pollution), and illegal disposal (improved environmental aesthetics).

Tire Recycling Loans

The loan offerings of tire funds through both the RMDZ Loan Program and the Tire Recycling Loan Program have not effectively attracted qualified applicants for tire recycling projects. The lack of qualified applicants is due in part to the infancy of the tire recycling industry and the stage of the businesses applying (often start-up). Of the two loans which have been awarded, one will soon be in foreclosure.

Tire Program Contracts

Contracts awarded by the IWMB have been effective in demonstrating technologies, generating data, and providing staff useful information for assisting businesses and developing markets. Results include technical information and publications which are available to the public upon request.

The attachments referenced in the Supplemental Report on the Tire Recycling Program are not included in an effort to reduce paper waste. Copies of the Tire Recycling Grant Abstracts for FY 1992-93 and FY 1993-94 will be available at the Administration Committee meeting on February 6, 1997. Copies are also available upon request by calling 916/255-2577.

FY 1992-93 AND 1993-94 GRANT RECIPIENTS

Actual Expenditures

END USE	REUSE	RETREADED	ENERGY ¹	CRUMB PRODUCTS	OTHER ² PRODUCTS	RAC	CIVIL ENGIN.	BUSINESS DEVELOPMENT	PLANNING & RESEARCH	LANDFILL DISPOSAL
RECIPIENT	CONTRACT #	AMOUNT PAID TO GRANTEE								
Action Engineering	TR-92-0034-19				\$29,700.00					
AET Systems	TR-92-0080-41			\$50,000.00						
Alameda County	C2086-01								(\$0.00) ³	
Alpine County	TR-93-0020-02						\$499.40			
B.A.S. Recycling Inc.	TR-93-0031-36			\$75,000.00						
B.A.S. Recycling Inc.	TR-92-0027-37			\$100,000.00						
Burke Industries	TR-92-0014-43			\$70,517.16						
CA Recycling Company	TR-92-0032-19				\$18,191.00					
Carsonite International	TR-93-0007-34			\$62,125.50						
Champion Recycling	TR-92-0036-36		\$50,000.00							
Champion Recycling	TR-93-0024-36			\$75,000.00						
Dave's Wheel & Tire	TR-92-0041-34						\$20,053.20			
Econtract	TR-93-0022-00						(\$0.00) ³			
El Dorado County	TR-92-0072-09						\$13,771.00			
Enviro--Med	TR-92-0052-37				\$20,000.00					
Frank Fargo	TR-93-0027-19	\$74,228.00								
Frenso, City of	TR-93-0039-10		\$8,425.59							
Geremia, Pasztor, Sadler	TR-92-0086-34			\$20,000.00						
Hap Fisher Associates	TR-92-0008-43			\$49,001.66						
Humboldt County	C2080-12								\$24,270.00	
Huntington Beach, City of	C2076-30					\$32,400.00				
Jackson and Church	TR-93-0061-00				(\$0.00) ³					
Jin Cheng Corporation	TR-92-0024-01							\$22,373.00		
Kern County	C2081-15				\$30,000.00					
Kern County	C2082-15								\$30,000.00	
Kern County	TR-93-0063-15		\$38,500.00							
Lake County	C2088-17									\$14,700.00
Lancaster, City of	TR-92-0030-19				\$73,305.00					
Lancaster, City of	TR-92-0045-19					\$22,141.47				
Lancaster, City of	TR-92-0051-19			\$50,000.00						
Long Beach, City of	TR-92-0096-19			\$44,657.00						
Los Angeles, City of	C2084-19					\$34,950.00				
Los Angeles, City of	C2085-19		\$28,208.71							
Lydia M. Frenzel	TR-92-0043-03								\$49,445.00	

- 21
1. Cement industry, MELP, and pyrolysis.
 2. Use of chipped, chopped, shredded, and whole tires.
 3. Grant agreement terminated.

TABLE 1
FY 1992-93 AND 1993-94 GRANT RECIPIENTS

Actual Expenditures

END USE		REUSE	RETREADED	ENERGY ¹	CRUMB PRODUCTS	OTHER ² PRODUCTS	RAC	CIVIL ENGIN.	BUSINESS DEVELOPMENT	PLANNING & RESEARCH	LANDFILL DISPOSAL
RECIPIENT	CONTRACT #	AMOUNT PAID TO GRANTEE									
Manhole Adjusting, Inc.	TR-92-0097-19								\$17,156.00		
Marine Forest Society	TR-92-0084-30					\$18,520.00					
Marine Forest Society	TR-93-0059-30									\$30,000.00	
Merced County	TR-93-0015-24			\$60,000.00							
Milpitas, City of	C2090-43			\$1,019.20							
Mortimer Tree Service	TR-92-0009-56					(\$0.00) ³					
Oakland, City of	C2089-01								\$40,000.00		
Oliver Rubber Company	TR-93-0008-01		(\$0.00) ³								
PACE	TR-92-0092-38					\$30,000.00					
PRK International	TR-92-0047-30			\$21,683.00							
Reco-Tech	TR-92-0020-07									\$44,125.66	
Sacramento County	C2087-34									\$40,000.00	
Sacramento County	TR-92-0003-34					\$49,250.00					
San Bernardino County	TR-93-0090-36			\$75,000.00							
San Bernardino, City of	TR-93-0016-36									\$37,280.00	
San Diego County	C2083-37										\$15,762.80
San Diego County	TR-93-0065-37		\$10,000.00								
San Diego, City of	C2079-37									\$4,945.00	
Shasta County	C2077-45			\$22,500.00							
Sonoma County	C2078-49			\$8,221.25							
South Lake Tahoe, City of	C2098-09							\$25,871.00			
SRI	TR-92-0064-41					\$68,847.00					
Stanislaus County	TR-93-0010-50			\$30,000.00							
TAK Consultant Engineer	TR-93-0093-30						\$65,340.00				
The Tireless Effort	TR-92-0035-21					\$60,000.00					
TRIB	TR-93-0018-27		\$58,109.89								
Trinity County	TR-93-0066-53			\$4,970.00							
UC Davis	TR-92-0081-57									\$55,858.00	
UC Davis	TR-92-0082-57				\$53,664.00						
Ventura County	TR-93-0030-56		\$15,000.00								
Walde, Leonard	TR-93-0042-07									\$60,300.00	
West Sacramento, City of	TR-93-0068-34			\$7,850.00							
Yolo County	C2091-57							\$19,488.32			
TOTALS	\$2,292,223.81	\$0.00	\$157,337.89	\$356,377.75	\$649,965.32	\$397,813.00	\$154,831.47	\$79,682.92	\$79,529.00	\$376,223.66	\$30,462.80

1. Cement industry, MELP, and pyrolysis.

2. Use of chipped, chopped, shredded, and whole tires.

3. Grant agreement terminated

TABLE 2
FY 1994-95 AND 1995-96 GRANT RECIPIENTS
 Grant Awards

END USE	REUSE	RETREADED	ENERGY ¹	CRUMB PRODUCTS	OTHER ² PRODUCTS	RAC	CIVIL ENGIN.	BUSINESS DEVELOPMENT	PLANNING & RESEARCH	LANDFILL DISPOSAL
RECIPIENT	CONTRACT #	AMOUNT AWARDED TO GRANTEE								
Agoura Hills, City of	TR5-95-1513					\$100,000.00				
Alameda, City of	TR-94-1039-01		\$4,688.00							
B.A.S. Recycling, Inc.	TR5-95-1545			\$100,000.00						
Calabasas, City of	TR-94-1069-19					\$13,750.00				
Calaveras County	TR-94-1070-05		\$27,500.00							
Cerritos, City of	TR5-95-1510					\$100,000.00				
Coalition Tech, Ltd.	TR-94-1006-00			\$75,000.00						
Create-A-Saurus	TR-94-1054-01				\$61,567.00					
Cyclean of L.A., LLC	TR5-95-1542					\$100,000.00				
Dr. Mohammed Ali	TR-94-1078-43			\$61,566.00						
ECOPAWE, Inc.	TR-94-1030-00					\$68,000.00				
El Dorado County	TR-94-1077-09		\$48,850.00							
Folsom, City of	TR5-95-1516			\$68,637.00						
Gainer & Associates	TR-94-1036-12						\$63,867.00			
Garden Grove, City of	TR5-95-1508					\$100,000.00				
Humboldt County	TR-94-1063-12						\$36,376.00			
Jurupa USD	TR-94-1040-33			\$50,000.00						
Kern County	TR-94-1028-15		\$37,500.00							
Lancaster, City of	TR-94-1065-19		\$56,600.00							
Marin County	TR-94-1047-21		\$16,800.00							
Mariposa County	TR-94-1003-22		\$2,250.00							
PRK Intntl. Mkt., Inc.	TR-94-1023-30							\$70,000.00		
Redwood Rubber	TR-94-1081-21				\$75,000.00					
Rialto, City of	TR-94-1037-36		\$8,760.00							
San Bernardino County	TR-94-1013-36		\$58,988.00							
San Clemente, City of	TR-94-1064-30			\$59,125.00						
San Diego County	TR-94-1067-37		\$29,884.00							
San Joaquin County	TR-94-1074-36						\$13,970.00			
San Jose, City of	TR-94-1046-43		\$33,110.00							
San Luis Obispo IWMA	TR5-95-1509						\$100,000.00			
Santa Clara County	TR-94-1011-43		\$14,610.00							
Siskiyou County	TR-94-1020-47				\$33,560.00					
T.Y.R.E.S. Inc.	TR-94-1002-36		\$75,000.00							
T.Y.R.E.S., Inc.	TR5-95-1502		\$100,000.00							

1. Cement industry, MELP, and pyrolysis.
2. Use of chipped, chopped, shredded, and whole tires.
3. Grant agreement terminated.

28

TABLE 2
FY 1994-95 AND 1995-96 GRANT RECIPIENTS
 Grant Awards

END USE		REUSE	RETREADED	ENERGY ¹	CRUMB PRODUCTS	OTHER ² PRODUCTS	RAC	CIVIL ENGIN.	BUSINESS DEVELOPMENT	PLANNING & RESEARCH	LANDFILL DISPOSAL
RECIPIENT	CONTRACT #	AMOUNT AWARDED TO GRANTEE									
TAK Consultant Engineer	TR-94-1073-30						\$75,000.00				
TAK Consulting Engineers	TR5-95-1532						\$38,618.00				
Uremet Corporation	TR-94-1072-30				(\$75,000.00) ³						
Victorville Finance Dept.	TR5-95-1561			\$12,744.28							
West Sacramento, City of	TR-94-1024-57			\$11,702.00							
Western Riverside	TR-94-1038-33				\$36,000.00						
Yolo County	TR-94-1033-57							\$63,000.00			
TOTALS	\$2,177,022.28	\$0.00	\$0.00	\$538,986.28	\$525,328.00	\$170,127.00	\$595,368.00	\$277,213.00	\$70,000.00	\$0.00	\$0.00

1. Cement industry, MELP, and pyrolysis.
 2. Use of chipped, chopped, shredded, and whole tires.
 3. Grant agreement terminated.