

“State of Dangerous Tree Blasting in BC – a preliminary review”

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Abstract

Interviews with thirty-one faller blasters in British Columbia were undertaken in the autumn of 2011 to determine their level of use of dangerous tree (DT) blasting and to explore any impediments to using this technique. In addition, blasting records of six DT blasters were reviewed to determine the average costs of blasting. Of those who were interviewed, 35% have yet to use DT blasting at their workplace, while 35% of the respondents use it frequently to regularly. The techniques used most by the respondents are window blasting (65%) and root blasting (58%), although root blasting is used more frequently (21% use root blasting regularly compared to only 13% who use window blasting on a regular basis). The average cost of using powder to perform a DT blast was \$70.64 per blast (based upon records of 46 blasts).

Coastal blasting is working moderately well but there is still resistance by some contractors and licensees to have the fallers do their own blasting. In the Interior, faller blasters have not been using their training because of limited to no access to powder in their worksites. Blasting by fallers is also perceived with varying levels of skepticism by the industry.

The DT blasting program needs to be further promoted by WorkSafe BC and the BC Forest Safety Council. In particular, the impediments to accessing powder need to be removed so that blasting is more available to fallers working in helicopter logging operations and fallers who work in the Interior. As a practice, blasting needs to be embraced as an integral 'tool' that fallers should not have to go without. Fallers working in decadent timber or rugged terrain with large diameter trees must have DT blasting readily available to help reduce the level of risk-taking. Safety performance and crew morale are greatly improved when fallers have DT blasting as an integral part of their safety plan. One cannot put a price on the cost of saving a faller's life by having DT blasting readily available – it is simply the right thing to do!

Introduction

The findings and recommendations of a 2009 Coroner's "Death Review Panel Convened to Examine Three 2008 Workplace Incidents Involving Tree Fallers" recommended that WorkSafe BC and the BC Forest Safety Council (BCFSC) undertake a study to assess the efficacy of alternate methods of conducting tree falling operations in high hazard areas. The Panel was of the opinion that consideration should be given to exploring new, alternate methods of conducting falling operations which focus on safety and may have the added benefit of reducing production costs. The Panel also recognized that the benefits of integrating safety into forestry operations might not be generally recognized by the industry. BCFSC engaged Integra Forest Consulting Ltd and D/T Blasting Ltd (the Consultants) to explore the state of dangerous tree blasting by fallers.

The state of DT blasting by fallers in BC is not well known. We know that several fallers were trained and certified as faller blasters and we know that blasting is a safe technique to remove dangerous trees, but we do not know how many faller blasters have used their training in their workplace or how frequently they use this technique.

Over the past few years, the BCFSC has promoted the DT blasting course developed by Western Forest Products Inc (WFP). This course trains fallers over a three day period to safely blast high risk dangerous trees. The goal of the training is to equip fallers with the ability to blast dangerous trees without the necessity of having to call and wait on the services of road crew blasters. The concept was based upon Dave Weymer's premise that **"it is easier to train a faller how to blast, than to train a blaster (road crew blaster) how to fall a tree"**. The belief is that if blasting can be made more readily available then fallers will be less inclined to take a chance and attempt to fall a high risk dangerous tree. However, of the more than 60 fallers who have received the training and certification as a DT blaster, there was anecdotal evidence that a number of these faller blasters are not using blasting at their work place.

The decision to fall a dangerous tree using explosives is consistent with the Occupational Health and Safety Regulation 26.26(3)¹. This study aimed at finding out the state of DT blasting by interviewing faller blasters. The focus of the interview was to find out how many are using DT blasting, what DT blasting techniques they are using, are there impediments to blasting, and to determine what additional support the BCFSC could make available to assist in further promoting the use of DT blasting.

This project was undertaken by Dave Weymer (D/T Blasting Ltd) and Dean McGeough (Integra Forest Consulting Ltd). The Consultants created a questionnaire to assist with data collection when contacting past participants of the dangerous tree blasting for faller's (DT Blasting) course. The blasting records for 46 DT blasts from 6 faller blasters were reviewed for cost comparisons. This project gathered true data on the cost implications and safety benefits of using blasting as an alternative to falling dangerous trees. The findings of this study will support fallers and improve the impediments caused by skeptics in the forest industry.

¹ **OHS Regulation 26.26(3)**: If conventional methods cannot be safely employed to fall a dangerous tree, blasting or other acceptable methods must be used.

Methods

A survey of thirty-one dangerous tree faller-blasters was done by phone interviews and/or by in-person meetings. The interview was based upon a questionnaire (appendix 1) to determine how many certified blasters are actively using the training they received. We also wanted to learn about the successes and impediments to using blasting to remove dangerous trees and to determine whether there is a need to further promote DT blasting in the industry. The questionnaire was built utilizing the following topics:

- Questionnaire item 1: Discovery of who is blasting and what techniques are being used.
- Questionnaire item 2: Relevance of training materials to field application
- Questionnaire item 3: Discover how fallers access powder in the workplace
- Questionnaire item 4: Exploring start-up experiences after training
- Questionnaire item 5: Discovering the impediments to using blasting
- Questionnaire item 6: Discovering the benefits of having blasting available
- Questionnaire item 7: Exploring how to promote blasting in the industry
- Questionnaire items 8 – 10: Exploring ways to promote competency and continuous improvement

When asked to comment on items 1 and 2 fallers were provided a frequency scale to categorize their response. The scale used was as follows:

1. Frequently (each week),
2. Regularly (once a month),
3. Occasionally (once every 6 months),
4. Rarely (once a year), and
5. Never.

For questionnaire items #3 through #10, the fallers were asked to select all items that applied. Information gathered from the surveys was then summarized for comparison. Not only will this information reveal the state of blasting by fallers, but it can also be used to improve the focus of the training and to help overcome impediments.

In addition to the interviews, copies of logbook entries for 46 danger tree blasts were gathered from six different blasters. Dave Weymer reviewed the logbook entries and calculated the cost of the explosives used to perform each blast. He applied a set of standard costs for the explosive materials from which an average cost could be generated.

Findings

The results of the questionnaire are summarized in appendix 1. From this information we see that 87% of the fallers interviewed are from the Coast while 13% are from the Interior. Of the fallers interviewed (table 1), 35.5% (11 of 31 respondents) have not used their DT blasting training at their worksite while 35.5% of the fallers use DT blasting on a frequent (weekly) to regular (monthly) basis. There are some fallers (29%) who use blasting on an occasional to rare basis (at least once every 6 months to a year).

Table 1: Frequency of using blasting

Item #1A	Frequently	Regularly	Occasionally	Rarely	Never	Total
<i>I use DT blasting in my workplace:</i>	2	9	4	5	11	31
	6.5%	29.0%	12.9%	16.1%	35.5%	

For those fallers who have utilized blasting since taking their training, we asked them to indicate the frequency they use the various blasting techniques (table 2). The following results were obtained from the twenty active faller blasters:

Table 2: Frequency of blasting techniques

Item #1B	Frequently	Regularly	Occasionally	Rarely	Never	Total
<i>I use Root Blasting (ANFO):</i>	1	6	7	4	2	20
	5%	30%	35%	20%	10%	
<i>I use external stem blasting (no cutting):</i>	0	2	1	3	14	20
	0%	10%	5%	15%	70%	
<i>I use window blasting:</i>	0	4	8	8	0	20
	0%	20%	40%	40%	0%	
<i>I use the back-strap blasting (partial cutup):</i>	0	1	1	5	13	20
	0%	5%	5%	25%	65%	

Blasting techniques taught in the course are varied. When asked which techniques the blasters are using, they indicate that back-strap blasting and external blasting are least used, while window blasting and root blasting are commonly used. In addition to the questionnaire, we reviewed 46 blasting logbook entries made by 6 blasters. In this log book review (appendix 2) a similar trend was found. Root blasting was used most (54% of the blasts), followed by window blasts (30.4%), and partial cut-up blasting (10.9%) and external blasting (4.3%) the least often methods. The majority of root blasts were to bring down large diameter Western redcedar. Stem blasting techniques are more applicable to smaller diameter stems, or in situations where there is a jack-pot of trees (although root blasting is also applicable). Regardless of the method, fallers have been using the blasting to safely overcome falling difficulties, to reduce their time spent on falling low-value high risk dangerous trees, and to avoid risk-taking where there is compromised escape routes.

A common response of participants taking the three day training is that there is a lot of material to review. In the questionnaire we asked them to rate the frequency that they reviewed the resources provided in the course. The following responses (table 3) were recorded by those who have been blasting in their workplace:

Table 3: Use of course reference materials

Item 2. Do you reference the course materials for information	Frequently	Regularly	Occasionally	Rarely	Never	Total
<i>Log book for blasting procedures:</i>	1	8	8	2	1	20
	5%	40%	40%	10%	5%	
<i>Log book for reminders on techniques:</i>	1	6	9	1	3	20
	5%	30%	45%	5%	15%	
<i>Workbook for review:</i>	0	2	5	7	6	20
	0%	10%	25%	35%	30%	
<i>Blaster's Handbook:</i>	0	5	4	6	5	20
	0%	25%	20%	30%	25%	

From the above responses we see that the log book is a source of information most often referenced by the faller. This booklet was designed to not only log their blasts, but also to provide checklists and images of the various blasting techniques so that it would be a field-ready resource book. The handbook and the course book are least likely to be referenced, but they are being used by blasters to varying levels, and most often when it is approaching their recertification exam.

The faller blasters were asked to comment on how powder is (or would be) accessed at their workplace and the following responses (table 4) were received:

Table 4: Acquisition of powder for the workplace

Item 3. How do you get powder for use at your workplace	COAST	INTERIOR
<i>I request the road crew to bring powder to my work site:</i>	16 (64%)	0
<i>I have a magazine user agreement and I transport what I need:</i>	9 (36%)	0
<i>I have a day-use mag licence to buy my own powder from vendor:</i>	0	0
<i>I have a shared mag licence but buy my own powder from vendor:</i>	0	0
<i>I do not have access to powder in my worksite:</i>	0	3 (75%)
<i>Not used yet</i>	7 (26% of fallers)	4 (100%)
<i>Not Applicable (low risk timber)</i>	0	1 (25%)

It is very apparent that the road crew blasters provide integral support for the coastal fallers wishing to gain access to powder when they need to blast a dangerous tree. This cooperation supports the safety of fallers because they have ready access to powder. When they encounter a high risk dangerous tree there is powder available by the licensee and blasting contractors. Effort needs to be taken to find ways to make powder readily available to fallers working in the Interior. Of the four Interior faller blasters interviewed, their main challenge is getting access to powder because there are very few powder magazines accessible to falling contractors.

It takes time for a newly certified faller blaster to become an experienced blaster. During the training the fallers are advised to seek help to build up their confidence and competency. To investigate the post-training learning process, we asked the fallers to identify their learning process. The following results were tallied:

Table 5: Start-up experience

Item 4. Indicate your start-up experience for using DT Blasting at your workplace:	Tally:	
<i>I mentored with a road crew blaster to build up my confidence;</i>	7	35%
<i>I mentored with Dazy to get established and going with blasting;</i>	3	15%
<i>I was able to mentor with a fellow DT blaster;</i>	0	0%
<i>I mentored with Dazy and a fellow DT blaster</i>	5	25%
<i>I mentored with Dazy, road crew blaster and fellow DT blaster</i>	1	5%
<i>I mentored with a road crew blaster and fellow DT blaster</i>	1	5%
<i>I did it on my own</i>	3	15%
<i>N/A - have not blasted yet</i>	11	

It is quite apparent that the majority of the faller blasters developed a team work strategy of seeking help from their road crew blaster and also to work with fellow faller blasters, including the instructor (Dave Weymer aka Dazy). Only 15% of the participants simply went out and applied their training on their own.

DT blasting is an important tool to have available to fallers, especially those working in decadent timber types or in complex topography. Blasting takes the faller away from the base of the tree when the tree is too hazardous to complete the final falling cut. Many fallers have commented on the vast benefits of having the option of blasting to get out of a high risk situation. We therefore wanted to find out why some fallers who were certified to blast have not performed any blasting.

We asked the fallers to select reasons for not using DT blasting at their workplace. In an attempt to capture why faller blasters have not been using this technique, the fallers were asked to consider the possible reasons why they do not blast, or do not blast as often as they envisioned when they took the training. The categories asked were:

- Reluctance at the workplace (table 7)
- Risk factors (table 8)
- Transportation barriers (table 9)
- Planning and coordination barriers (table 10)
- Other factors (table 11)

A significant number of the faller blasters responded that they did not encounter any impediments to using DT blasting when they returned to their workplace with their certification. For this series of questions the responses from those who do not blast were separated from those who are blasting at their workplace. In this way we could identify trends across these groups of faller blasters. Note that for each category a faller may have selected more than one causal factor.

Table 7: Sources of impediments at the workplace

Reluctance at workplace:	Fallers not blasting		Fallers who blast	
<i>Crew</i>	1	9.1%	1	4%
<i>Prime Contractor</i>	5	45.5%	3	13%
<i>Blasting Contractor</i>	1	9.1%	3	13%
<i>Licensee</i>	4	36.4%	0	0%
<i>Other</i>	0	0.0%	0	0%
N/A - no issue	0	0.0%	16	70%

Of the blasters who have not used DT blasting, they cite the main impediments are from a reluctance on the part of the licensee and prime contractor, followed by the blasting contractor and their falling crew to have fallers do their own blasting. For those who are using blasting, where there is reluctance, they cited the prime contractor and blasting contractor to be their main challenges, and to a lesser extent, a reluctance of their crew to request blasting. For blasters in the Interior of BC, their main obstacle to blasting is a lack of access to powder magazines.

The fallers suggested the following as reasons why there is not an open embrace of faller blasters:

- Liability concerns relating to powder handling and storage (risk of losing a mag license)
- Lack of understanding and skepticism about the benefits of having blasting delivered by fallers
- Challenging coordination issues (road crew not always available and they have the powder)
- Powder storage challenges with remote helicopter logging operations (there is no road crew with a magazine)
- Lack of access to powder magazines or skepticism by owners of powder magazines
- History of road crew blasters doing the job and not wanting to give it up
- Access to powder not always available when it is needed

Using explosives to fall dangerous trees can be limited by perceived and real risk concerns. For example, diminished use during high fire hazard conditions is a very real concern and was cited by 35% of the faller blasters. Security of the powder magazine and on-site powder storage is a risk factor causing some to not have blasting as readily available. To a minor extent, overlapping phases (worksite congestion) is another cause for reduced DT blasting.

Table 8: Sources of risk factors

Risk Factors:	Fallers not blasting		Fallers who blast	
<i>Fire Hazard</i>	0	0%	8	36%
<i>Magazine Security</i>	1	9%	2	9%
<i>Air Traffic</i>	0	0%	0	0%
<i>Public Traffic</i>	0	0%	0	0%
<i>Worksite Congestion</i>	0	0%	1	5%
N/A - no issue	10	91%	11	50%

Depending upon where a faller blaster is working, there are risk factors that result in a reduction in the amount of DT blasting that is undertaken. Concerns over powder magazine security (table 9) is something that can be worked out by bringing the faller blaster together with the blasting contractor to work out an arrangement that does not violate Federal regulations over magazine storage of explosives. In the Interior of BC, where magazines are simply not as plentiful as on the Coast, there will need to be creative means to make overnight storage of explosives more accessible to fallers. Perhaps it will require more up-front planning to identify the needs prior to start-up and then making arrangements for

explosives and storage. On-site storage in remote areas accessed by helicopter is cited as a problem, but can be overcome by applying for an exemption to the restricted use of a type 6 magazine. Transporting explosives in the crew vehicle is a further challenge. Fortunately this is one concern that can be overcome with minor vehicle adaptations to comply with WorkSafe BC and the Transportation of Dangerous Goods Regulation.

Table 9: Transportation barriers

Transportation Barriers:	Fallers not blasting		Fallers who blast	
On-Site Powder Storage	2	18%	2	10%
Crew Vehicle	3	27%	4	19%
Aircraft	0	0%	0	0%
Crew Boat	0	0%	0	0%
N/A - no issue	6	55%	15	71%

Table 10: Planning and coordination barriers

Planning & Coordination Barriers:	Fallers not blasting		Fallers who blast	
<i>Product Inventory</i>	0	0%	0	0%
<i>Phase Shutdowns</i>	0	0%	0	0%
<i>Limited Access to Magazine</i>	6	55%	3	15%
<i>Personal workload</i>	0	0%	0	0%
N/A - no issue	5	45%	17	85%

In the Interior, faller blasters are hampered by the lack of access to powder magazines. Consequently, this is an area where the fallers and planners will need to focus on identifying high risk dangerous trees early in the worksite safety planning process. If they can identify the need for explosives early, then there will be sufficient lead time to make arrangements for powder magazines in support of this faller safety initiative.

In Coastal falling operations, respondents indicate that access to powder is problematic for remote helicopter logging operations or in situations where the road crew's shift is out of sequence with the faller's schedule. These impediments can be overcome with careful planning and scheduling. Contractors can obtain an exemption to the restriction to use Type 6 magazines for use in remote locations, thereby enabling fallers to bring their own powder to helicopter operations or to remote sites where the road crews may not be operating.

A number of other factors (table 11) explain why some faller blasters are not using explosives. Although not a barrier to safety, some fallers do not blast because they are working in low-risk timber or have alternative means to remove dangerous trees (e.g., machine assist). For six of the fallers (18% of all respondents) they have decided not to blast as a matter of personal choice. For some of these fallers they see the road crew blasters as the expert and defer to asking them to remove their dangerous trees. An interesting discovery is that no one attributed cost to be an impediment to blasting.

Table 11: Other factors impeding use of blasting

Other Factors:	Fallers not blasting		Fallers who blast	
<i>Low Risk Timber</i>	5	46%	2	9%
<i>Personal Choice</i>	3	27%	3	13%
<i>Alternatives Available</i>	0	0%	1	4%
<i>Too Expensive</i>	0	0%	0	0%
<i>N/A - no issue</i>	3	27%	17	74%

Of interest to many persons is the question, “what is the cost/benefit” of having faller blasters take care of their high risk dangerous trees. Overwhelmingly the fallers indicated (table 12) that reduced risk taking and improved crew morale are the significant benefits to having DT blasting available. In addition, there is improved planning. Workers are taking the time to look ahead for high risk dangerous trees and making a plan to deal with these earlier and in a coordinated approach. The sooner the blaster is notified of a dangerous tree the more likely blasting will be used in a timely manner that does not negatively affect production. The cost of using explosives, or the money saved, is of less concern. Fallers acknowledge there is a cost (both direct and indirect) but they indicated that the benefit of blasting is above the cost of taking the risk of injury or loss of life by tackling a high risk DT with the saw.

Table 12: Benefits of gaining access to DT blasting

Item 6. Describe the benefits you and/or your crew attribute to having DT blasting available:		
<i>Cost Savings - direct</i>	3	3%
<i>Cost Savings - indirect</i>	7	8%
<i>Production Increase</i>	6	7%
<i>Reduced risk taking</i>	30	33%
<i>Improved Morale</i>	29	32%
<i>Improved planning</i>	16	17%

In addition to exploring the use of blasting, the questionnaire also surveyed how DT blasting could be promoted across the industry. The faller blasters were also asked if they would benefit from mentoring and having a study session prior to taking the recertification examination. Faller blasters were also asked to respond to the creation of a periodic newsletter to help keep them informed of techniques, tips, questions and answers.

In the questionnaire, item #7 asked the fallers to suggest ways to further promote DT Blasting. The responses to this enquiry were varied and are summarized in appendix 2. Most noteworthy is that the industry needs to recognize the importance of making blasting a tool that must be readily available to support each faller. Without it fallers will take chances rather than walk away from high risk dangerous trees.

For questionnaire items #8 through #10, providing on-going support to the faller blaster is highly recognized to be a valuable investment. Fallers want to learn how to do it ‘for real’ (i.e., out of the course environment) because it is not a perfect science. It takes a process of practice and continuous improvement to move forward. Fallers are in favour of getting field support while they learn to apply blasting to their worksite. Of the respondents, 84% claimed they would welcome on-site mentoring with Dave Weymer. In addition, having a classroom study session (by 71% of respondents) is desirable when attempting to study for their next blaster’s examination. When asked about receiving a newsletter, 94% of the respondents indicated that a newsletter would be a great communication tool for the blasters.

Cost of Blasting

A review of the log book entries for 46 blasts from six faller blasters was made. For each blast the powder costs were calculated by Dave Weymer based upon a standardized price list and summarized for reference (appendix 2). The average cost of DT blasting was \$70.64 per blast, with a range from a low of \$35.00 for a single tree blast, to a high of \$150.00 for a multiple tree blast. Table 13 provides a comparative summary of costs by type of blast and tree species. The powder costs by tree species being blasted ranged from \$35.00 to \$85.00 and are dependent upon the complexity of the blast and size of the tree. In several of the blasts, more than one tree was being felled using the explosives.

Cut-up tree blasting was the most expensive type of blast. However, a review of the records indicates that three of the five blasts were multiple tree blasts. The pricing ranged from \$55.00 to \$100.00 for this technique. Root blasting was the next most expensive technique (\$73.10 per blast) and mainly attributed to the larger trees that were being blasted. The least expensive blasting was found to be the external stem blasting (no saw work required) at \$54.00 per blast, and \$66.36 for window blasting (a window is cut into the tree).

A shortcoming of the study is a review of the time it took the blasters to perform the blasts so that a full treatment cost could be made. It would also be of interest to ask each faller to estimate the time it may have taken to utilize alternative measures for tree removal if blasting by the faller blaster was not possible. For example, a comparison of the cost in time and actual dollars to wait for the road crew blaster or to utilize machine assist techniques could be made. Perhaps these cost comparisons can be performed in the future.

Table 13: Summary Costs of DT Blasting

Blast Type	Number	Avg Cost
Window	14 (30.4%)	\$ 66.36
Root	25 (54.4%)	\$ 73.10
External	2 (4.3%)	\$ 54.00
Cut-up	5 (10.9%)	\$ 77.00
Redcedar	38 (80.9%)	\$ 69.79
Spruce	2 (4.3%)	\$ 85.00
Hemlock	6 (12.8%)	\$ 65.42
Balsam	1 (2%)	\$ 35.00

Discussion and Recommendations

The forest industry has been using explosives to remove dangerous trees for several decades. The Occupational Health and Safety Regulations require that blasting (or other acceptable methods) be used if conventional methods of DT falling cannot be safely employed. However, a formalized process to certifying fallers to perform blasting has only occurred since 2006. This initiative is a very positive step forward in faller safety. WFP is a key proponent and strives to make blasting available in every operation to support the fallers. One of WFP's Woodland Managers, Ken Mackenzie, attended a DT blasting demonstration and declared afterwards, ***"This [DT Blasting] program is going to save lives!"*** We need the forest industry to embrace DT blasting so fallers have no reason to take chances with dangerous trees. The cost of a life is not worth it!

Everyone in the forest industry needs to recognize the merits of DT blasting. It should be regarded as any other tool a professional faller uses to do his job efficiently and safely. In the DTB courses, it is often stated, ***“You would not go falling without your axe in your toolbelt, why go to work without DT blasting!”*** The benefits of having blasting done by the faller are many:

- He knows the hazards of the tree;
- He knows whether the tree can take a cut for powder placement;
- He can use stem preparation techniques to use less powder and reduce post-blast hazards;
- The faller blaster is able to effectively plan the blast to be least disruptive to production;
- The faller blaster is with his crew and is therefore able to intervene when one of his crew encounters a high risk dangerous tree or to overcome a falling difficulty.

When asked about having blasters readily available, faller blaster Gunnar Wigard said, ***“There is less stress on the guys knowing they don’t have to tackle the ugly, life-threatening danger tree [in their quarter]”***. Falling contractor Marc Centrone, owner of Westcoast Falling Ltd in Holberg, has 28 years of falling experience on Northern Vancouver Island and he states, ***“Without blasting available a faller has one less option to overcome falling difficulties.”*** Marc has had blasting available in his workplace for almost 25 years and currently is very fortunate to have 4 certified Danger tree blasters onsite (including himself). He would not want to operate on a day to day basis without a Danger tree blaster onsite!

There are a number of constructive ways to promote and expand the use of DT blasting in BC.

- Reduce the cost of taking the DT blasting training (it is prohibitive, and is therefore a barrier);
- New Faller Trainees need to see DT blasting in action;
- Faller Supervisor Training needs to have modules of both DT awareness and DT blasting;
- Hard-rock Surface Blasters need training and endorsement for DT blasting;
- BCFSC needs to liaise with other blasting groups for continuous improvement of DT blasting;
- WorkSafe BC and the BCFSC continue to promote DT blasting with video and website information;
- Industry should consider making DT blasting a mandatory provision in falling contracts (will overcome some barriers to accessing powder); and
- Transport and Storage of explosives needs to be streamlined with leadership from Industry and Suppliers.

New faller training and faller supervisor training should include DT awareness training and DT blasting awareness. This can be provided using video footage and having a live demonstration. It is imperative that fallers and supervisors are aware of what makes a DT too dangerous to hand fall, and also to see what DT blasting can do to improve their safety program. New fallers need to realize the support that should be available to them.

Hard rock surface blasters should also receive DT blasting training to learn how to cooperatively work with fallers to effectively use less powder or how to strategically place powder to achieve the desired results (i.e., lessen the collateral damage caused by over-loading with explosives). A common criticism of the rock blaster called out to blast a DT is their tendency to overload and create ‘new hazards’ for the faller. A piloted version of the DT blasting course was created for hard rock surface blasters; this needs to be finalized and delivered to blasters without delay.

Since its inception, the DT Blasting program is continuously improving. Trainers working in consultation with WorkSafe BC have made improvements to ensure trainees are able to safely handle explosives and select the technique that is safe and successful in controlling the hazards. Further improvements can be achieved by liaising with other user groups to share and learn new ideas, along with techniques and explosive products that will make the task easier and more likely to be used. For example, the National Explosives Technical Advisory Group (NEBTAG) from the US Forest Service holds annual workshops to review the state of DT blasting. Both Dave Weymer and Dean McGeough have participated with this group for the purposes of advancing knowledge and sharing learning outcomes. Presently NEBTAG is seeking partnership with blasters to develop a chart of explosive factors specific to DT blasting. This would be a great opportunity for the BCFSC to facilitate this initiative and further advance blasting in BC.

Recently WorkSafe BC has produced informative safety videos. A similar effort should be made to help promote the use of DT blasting with an emphasis that it is there and must be available to fallers. Video testimonials may also be an effective way to communicate its importance.

To ensure the training stays current and acceptable to WorkSafe BC, funding is required to finalize training materials for hard-rock surface blasters and to get this training into the industry. In addition, the faller blaster course should be updated to incorporate learning outcomes from recent deliveries, input changes in product material and use, as well as to finalize the DT blasting log book so that it is provided to fallers as a field rugged guide.

This study took a preliminary review of DT blasting. However, only 31 of approximately 75 certified faller blasters were contacted, and all should have a voice in this program. Furthermore, we need to interview hard rock surface (road crew) blasters who perform DT blasting to determine their level of involvement, determine the impediments they encounter and then extend training to them so they can work effectively and safely with the fallers.

The next step is for the BCFSC to contact Licensees and Prime Contractors and promote the use of DT blasting. To assist in lobbying the industry to make DT blasting more readily available, BCFSC can consider conducting a more in-depth review of a cost comparison of fallers blasting compared to hard rock surface blasters.

DT blasting will reduce risk-taking and increase faller safety as a direct consequence. Fallers need access to DT blasting, and the Licensees and Prime Contractors can help remove the barriers, regardless of whether it is a conventional or helicopter operation, at a local or remote location. As Ken Mackenzie said, “this program is going to save lives” and regardless of whom does the blasting!

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“State of Dangerous Tree Blasting in BC – a preliminary review”

Appendix 1:

- Blank Questionnaire
- Summaries of responses

Danger Tree Blasting Questionnaire 2011

Date Questionnaire Completed (mm/dd/yr): _____ DT Blaster's Name: _____
 DTB Certificate Number: _____ DTB Certificate Expiration Date: _____ Recertified (circle): Yes No
 Location of my workplace: Vancouver Island South Coast Mainland North Coast Mainland
 Central Interior Northern Interior Southern Interior

Please use the following **Rating scale:**
 1 - frequently 2 - regularly 3 - occasionally 4 - rarely 5 - never

1. Since certification, please complete the following using the above rating scale (frequently = each week, regularly = once a month, occasionally = once every 6 months, rarely = once a year)?

I use DT blasting in my workplace:	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
I use Root Blasting (ANFO):	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
I use external stem blasting (no cutting):	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
I use window blasting:	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
I use the back-strap blasting (partial cutup):	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>

2. Do you reference the course materials for information (use the above rating scale):

Log book for blasting procedures:	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Log book for reminders on techniques:	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Workbook for review:	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Blaster's Handbook:	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>

3. How do you get powder for use at your workplace?

I request the road crew to bring powder to my work site:

I have a magazine user agreement and I transport what I need:

I have a day-use mag licence to buy my own powder from vendor:

I have a shared mag licence but buy my own powder from vendor:

I do not have access to powder in my worksite:

Comments:

4. Indicate your start-up experience for using DT Blasting at your workplace:

I mentored with a road crew blaster to build up my confidence;

I mentored with Dazy to get established and going with blasting;

I was able to mentor with a fellow DT blaster;

Getting a magazine licence and access to powder was difficult;

Getting powder delivered to the worksite was difficult;

It took time to convince the crew to adopt DT blasting as a tool;

Comments:

5. Describe what prevents you from using DT Blasting at your worksite (select all that apply):

Reluctance at worksite:

Crew Prime Contractor Blasting Contractor Licensee Other:

Risk factors:

Fire Hazard Magazine security Air traffic Public traffic Worksite congestion

Transportation Barriers:

On-site Powder Storage Crew vehicle Aircraft Crew boat

Planning and Coordination Barriers:

Product inventory Phase shutdowns Limited access to magazine Personal workload

Other factors:

Low risk timber Personal choice Alternatives available Too expensive

6. Describe the benefits you and/or your crew attribute to having DT blasting available:

Cost savings – direct Cost savings – indirect Production increase

Reduced risk taking Improved morale Improved planning

Other (please describe)

7. Please provide additional comments or recommendations on how D/T blasting can be promoted:

8. Would you welcome an on-site mentoring session by Dazy? Yes or No; if Yes, what time of year and what are your main needs?

9. Would you attend a pre-exam study session before recertifying? Yes or No; if Yes, what format?

Conference call Personal phone call Class room session

10. Do you think a Newsletter (new techniques, product updates, questions & answers) from the trainers would be beneficial for you? Yes or No

Summary of: Danger Tree Blasting Questionnaire 2011

GENERAL INFORMATION:

All Respondants

Workplace Location:	Tally:	
Vancouver Island:	20	65%
N Coast Mainland	1	3%
S Coast Mainland	0	0%
Central Interior:	3	10%
Northern Interior:	1	3%
Southern Interior	0	0%
Van Isle / SC and NC Mainland	2	6%
SC and NC Mainland	1	3%
No Answer:	3	10%
Number of Blasters:	31	

Recertified Course:	Yes	No	No Answer	
	5	12	14	31
	16%	39%	45%	

Rating Scale:	1	2	3	4	5
	Frequently	Regularly	Occasionally	Rarely	Never

QUESTIONS:

1. Since certification, please complete the following using the above rating scale: (frequently = 1x/week, regularly = 1x/month, occasionally = every 6 months, rarely = yearly)

	1	2	3	4	5	
	Frequently	Regularly	Occasionally	Rarely	Never	
I use DT blasting in my workplace:	2	9	4	5	11	31
	6.5%	29.0%	12.9%	16.1%	35.5%	
I use Root Blasting (ANFO):	1	6	7	4	2	20
	5%	30%	35%	20%	10%	
I use external stem blasting (no cutting):	0	2	1	3	14	20
	0%	10%	5%	15%	70%	
I use window blasting:	0	4	8	8	0	20
	0%	20%	40%	40%	0%	
I use the back-strap blasting (partial cutup):	0	1	1	5	13	20
	0%	5%	5%	25%	65%	

2. Do you reference the course materials for information?

	1	2	3	4	5	
	Frequently	Regularly	Occasionally	Rarely	Never	
Log book for blasting procedures:	1	8	8	2	1	20
	5%	40%	40%	10%	5%	
Log book for reminders on techniques:	1	6	9	1	3	20
	5%	30%	45%	5%	15%	
Workbook for review:	0	2	5	7	6	20
	0%	10%	25%	35%	30%	
Blaster's Handbook:	0	5	4	6	5	20
	0%	25%	20%	30%	25%	

* The students who answered N/A to all sections in question #2, all noted that they would use it, but have yet to use DT blasting

3. How do you get powder for use at your workplace

	COAST		INTERIOR	
I request the road crew to bring powder to my work site:	16	64%	0	0%
I have a magazine user agreement and I transport what I need:	9	36%	0	0%
I have a day-use mag licence to buy my own powder from vendor:	0	0%	0	0%
I have a shared mag licence but buy my own powder from vendor:	0	0%	0	0%
I do not have access to powder in my worksite:	0	0%	3	75%
Not used yet	7	26%	4	100%
N/A (Not applicable)	0	0%	1	25%

4. Indicate your start-up experience for using DT Blasting at your workplace:

	Tally:	
I mentored with a road crew blaster to build up my confidence:	7	35%
I mentored with Dazy to get established and going with blasting:	3	15%
I was able to mentor with a fellow DT blaster:	0	0%
I mentored with Dazy and a fellow DT blaster	5	25%
I mentored with Dazy, road crew blaster and fellow DT blaster	1	5%
I mentored with a road crew blaster and fellow DT blaster	1	5%
I did it on my own	3	15%

Summary of: Danger Tree Blasting Questionnaire 2011

Active Blasting

From Faller Blasters who indicated they actively blasted since training

5. Describe what prevents you from using DT Blasting at your worksite (select all that apply)

Reluctance at workplace:				Risk Factors:			
<i>Crew</i>	1		4%	<i>Fire Hazard</i>	8		36%
<i>Prime Contractor</i>	3		13%	<i>Magazine Security</i>	2		9%
<i>Blasting Contractor</i>	3		13%	<i>Air Traffic</i>	0		0%
<i>Licensee</i>	0		0%	<i>Public Traffic</i>	0		0%
<i>Other</i>	0		0%	<i>Worksite Congestion</i>	1		5%
<i>N/A - no issue</i>	16		70%	<i>N/A - no issue</i>	11		50%
	23				22		
Planning & Coordination Barriers:				Other Factors:			
<i>Product Inventory</i>	0		0%	<i>Low Risk Timber</i>	2		9%
<i>Phase Shutdowns</i>	0		0%	<i>Personal Choice</i>	3		13%
<i>Limited Access to Magazine</i>	3		15%	<i>Alternatives Available</i>	1		4%
<i>Personal workload</i>	0		0%	<i>Too Expensive</i>	0		0%
<i>N/A - no issue</i>	17		85%	<i>N/A - no issue</i>	17		74%
	20				23		
Transportation Barriers:							
<i>On-Site Powder Storage</i>	2		10%				
<i>Crew Vehicle</i>	4		19%				
<i>Aircraft</i>	0		0%				
<i>Crew Boat</i>	0		0%				
<i>N/A - no issue</i>	15		71%				
	21						

Comments:

1. Problems with powder storage on heli-sites
2. Poor coordination
3. Road crews are worried about liability issues
4. Lack of understanding of DTB program by licensees and contractors
5. R/C Blasters are used to doing it themselves and don't like to give it up

6. Describe the benefits you and/or your crew attribute to having DT blasting available:

<i>Cost Savings - direct</i>	3		5%
<i>Cost Savings - indirect</i>	7		11%
<i>Production Increase</i>	5		8%
<i>Reduced risk taking</i>	20		31%
<i>Improved Morale</i>	19		29%
<i>Improved planning</i>	11		17%
	65		

Comments:

1. Biggest thing in faller safety in a long time
2. Guys have stopped trying to tackle something they should be blasting

Summary of: Danger Tree Blasting Questionnaire 2011

Inactive Blasters

From Faller Blasters who indicated they have NOT blasted since training

5. Describe what prevents you from using DT Blasting at your worksite (select all that apply)

Reluctance at workplace:			Risk Factors:		
<i>Crew</i>	1	9.1%	<i>Fire Hazard</i>	0	0%
<i>Prime Contractor</i>	5	45.5%	<i>Magazine Security</i>	1	9%
<i>Blasting Contractor</i>	1	9.1%	<i>Air Traffic</i>	0	0%
<i>Licensee</i>	4	36.4%	<i>Public Traffic</i>	0	0%
<i>Other</i>	0	0.0%	<i>Worksite Congestion</i>	0	0%
<i>N/A - no issue</i>	0	0.0%	<i>N/A - no issue</i>	10	91%

Planning & Coordination Barriers:			Other Factors:		
<i>Product Inventory</i>	0	0%	<i>Low Risk Timber</i>	5	45.5%
<i>Phase Shutdowns</i>	0	0%	<i>Personal Choice</i>	3	27.3%
<i>Limited Access to Magazine</i>	6	55%	<i>Alternatives Available</i>	0	0.0%
<i>Personal workload</i>	0	0%	<i>Too Expensive</i>	0	0.0%
<i>N/A - no issue</i>	5	45%	<i>N/A - no issue</i>	3	27.3%

Transportation Barriers:		
<i>On-Site Powder Storage</i>	2	18%
<i>Crew Vehicle</i>	3	27%
<i>Aircraft</i>	0	0%
<i>Crew Boat</i>	0	0%
<i>N/A - no issue</i>	6	55%

Comments:

- Problems with powder storage on heli-sites
- Better access to powder
- Low risk timber or mechanical falling - don't need it

6. Describe the benefits you and/or your crew attribute to having DT blasting available:

<i>Cost Savings - direct</i>	0	0%
<i>Cost Savings - indirect</i>	0	0%
<i>Production Increase</i>	1	4%
<i>Reduced risk taking</i>	10	38%
<i>Improved Morale</i>	10	38%
<i>Improved planning</i>	5	19%

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Comments:

- 1. Hard to implement in some locations

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Appendix 2:

- DT Blasting Log Book Summaries and Costs

Blast	Location	Name	Species	Size (m)	Hazards	Type of Blast	Powder Cost	Comments
1	Port McNeill	Hugh Morgan	Cw	1.8	slabs	root	\$ 70.00	no issues
2	Holberg	Marc Centroni	Cw	1.8	hang-up	root	\$ 70.00	required pusher for hang-up
3	Holberg	Marc Centroni	Cw	1.8	slabs	root	\$ 70.00	no issues
4	Holberg	Marc Centroni	Cw	1.3	barber chair	root	\$ 70.00	no issues
5	Holberg	Dusko Spasenic	Cw	0.9	high roots	root	\$ 70.00	no issues
6	Holberg	Marc Centroni	Cw	2.1	split	root	\$ 70.00	no issues
7	Holberg	Dusko Spasenic	Hw	0.8	hang-up	root	\$ 100.00	down with Cw - 2 tree blast
8	Holberg	Marc Centroni	Hw	0.9	decay	window	\$ 45.00	no issues
9	Holberg	Dusko Spasenic	Hw	0.7	decay	window	\$ 45.00	no issues
10	Holberg	Marc Centroni	Cw	2.1	hang-up	root	\$ 70.00	no issues
11	Holberg	Dusko Spasenic	Hw	1.2	decay	root	\$ 70.00	no issues
12	Holberg	Marc Centroni	Cw	3.6	hang-up	window	\$ 150.00	down with Cw - 2 tree blast
13	Holberg	Dusko Spasenic	Cw	2.0	tied to 2nd tree	root	\$ 100.00	down with Cw - 2 tree blast
14	Holberg	Marc Centroni	Cw	2.1	split	root	\$ 70.00	no issues
15	Holberg	Dusko Spasenic	Ss	1.3	hang-up	window	\$ 70.00	no issues
16	Holberg	Marc Centroni	Cw	3.1	teepee	cut-up	\$ 70.00	no issues
17	Holberg	Dusko Spasenic	Ss	2.1	decay	cut-up	\$ 100.00	no issues
18	Holberg	Marc Centroni	Cw	3.1	split	root	\$ 70.00	no issues
19	Holberg	Marc Centroni	Cw	2.1	burnt	root	\$ 70.00	required slab to be cut
20	Holberg	Marc Centroni	Cw	1.8	slabs	root	\$ 70.00	no issues
21	Port McNeill	Weymer, Dave	Cw		?	root	\$ 35.00	required slab to be cut
22	Port McNeill	Weymer, Dave	Ba		?	root	\$ 35.00	no issues
23	Port McNeill	Jack, Dennis	Cw		hang-up	cut-up	\$ 70.00	down with Cw - 2 tree blast
24	Port McNeill	Jack, Dennis	Cw		slabs	external	\$ 58.00	no issues
25	Holberg	Jack, Dennis	Cw		hang-up	cut-up	\$ 90.00	no issues
26	Holberg	Jack, Dennis	Cw		hang-up	root	\$ 65.00	no issues
27	Holberg	Jack, Dennis	Cw		teepee	root	\$ 115.00	multiple tree blast
28	Holberg	Jack, Dennis	Cw		unstable slab	root	\$ 70.00	no issues
29	Holberg	Jack, Dennis	Cw		teepee	cut-up	\$ 55.00	no issues
30	Holberg	Jack, Dennis	Cw		unstable slab	stem hole	\$ 55.00	required slab to be cut
31	InterFor	Gunnar Wigard	Cw	1.5	leaner	window	\$ 85.00	no issues
32	Sir Edmund Bay	Gunnar Wigard	Cw	1.8	uprooted	window	\$ 65.00	no issues
33	Stafford Bay	Gunnar Wigard	Cw	1.5	no escape	root	\$ 80.00	no issues
34	Stafford Bay	Gunnar Wigard	Hw	1.1	overhead hazards	root	\$ 62.50	no issues
35	Charlotte Point	Gunnar Wigard	Cw	1.2	split	root	\$ 50.00	no issues
36	Charlotte Point	Gunnar Wigard	Cw	1.5	hollow	root	\$ 50.00	no issues
37	Charlotte Point	Gunnar Wigard	Cw	1.2	hang-up	window	\$ 50.00	no issues
38	InterFor	Gunnar Wigard	Cw	2.4	top hazard	window	\$ 77.00	no issues
39	Charlotte Point	Gunnar Wigard	Cw	1.5	top hazard	window	\$ 52.00	no issues
40	Carver Cove	Gunnar Wigard	Cw	2.3	top hazard	root	\$ 85.00	no issues
41	Carver Cove	Gunnar Wigard	Cw	1.2	decay	external	\$ 50.00	no issues
42	Holberg	Gunnar Wigard	Cw	2.1	overhead hazards	window	\$ 70.00	no issues
43	Holberg	Gunnar Wigard	Cw	1.3	hang-up	window	\$ 55.00	2 tree blast
44	Holberg	Gunnar Wigard	Hw/Cw	1.1	teepee	root	\$ 140.00	4 tree blast
45	Holberg	Gunnar Wigard	Cw	1.8	hang-up	window	\$ 55.00	no issues
46	Lone Bay	Gunnar Wigard	Cw	0.9	overhead hazards	window	\$ 55.00	no issues

\$ 3,249.50

Average Cost: \$ 70.64

Blast Type	Number	Avg Cost	Window	Root	external	Cut-up
Window	14 (30.4%)	\$ 66.36				
Root	25 (54.4%)	\$ 73.10				
External	2 (4.3%)	\$ 54.00				
Cut-up	5 (10.9%)	\$ 77.00				
Redcedar	38 (80.9%)	\$ 69.79	11	21	2	4
Spruce	2 (4.3%)	\$ 85.00	1	0	0	1
Hemlock	6 (12.8%)	\$ 65.42	2	4	0	0
Balsam	1 (2%)	\$ 35.00	0	1	0	0